



Brown and Caldwell

**Health and Safety Plan
For Remedial Investigation
At The LCP Chemicals, Inc.
Superfund Site**

July 2001

**HEALTH AND SAFETY PLAN
FOR REMEDIAL INVESTIGATION
AT THE LCP CHEMICALS, INC. SUPERFUND SITE**

Prepared for:

**ISP Environmental Services Inc.
1361 Alps Road
Wayne, New Jersey 07470**

Prepared by:

**Brown and Caldwell
440 Franklin Turnpike
Mahwah, New Jersey 07430**

July 2001

21405.101

HEALTH AND SAFETY PLAN
for
Remedial Investigation Activities at the LCP Chemicals Inc. Superfund Site

Effective June 2001 through December 2002

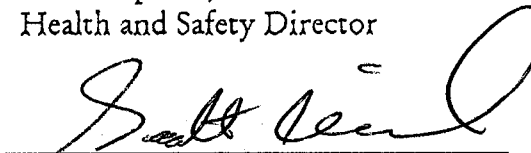
Reviewed/Approved
by:



Anne Baptiste, CIH
Health and Safety Director

Date: June 8, 2001

Reviewed/Approved
by:



Scott MacMillin
Project Manager

Date: 6/14/01

This document has been prepared for the express use of Brown and Caldwell and its employees and may be used as a guidance document by properly trained and experienced subcontractors. Due to the hazardous nature of this site and the activity occurring as part of the corrective action on-site, it is not possible to discover, evaluate, and provide protection for all possible hazards which may be encountered and this document does not guarantee the health and safety of any person entering this site. Strict adherence to the health and safety guidelines presented herein will reduce, but not eliminate, the possibility for injury at this site. Guidelines presented herein are site specific and should not be used for other sites without research and evaluation by a qualified health and safety specialist.

Each of the on-site subcontractors are responsible for their own health and safety program and the health and safety of their own employees. This requirement is based on OSHA regulations, which recognize the employer-to-employee responsibility for health and safety. A copy of their written program must be submitted for review to Brown and Caldwell, if requested. In an effort to assist the subcontractors, and to comply with hazard communication requirements, Brown and Caldwell will provide a copy of the site safety and health plan for this project to each subcontractor for implementation for the subcontractor's employees.

TABLE OF CONTENTS

Page No.

Acknowledgment Page	
Table of Contents	i
List of Tables	iv
List of Figures	v
 1.0 INTRODUCTION	 1-1
1.1 Scope and Applicability of Health and Safety Plan	1-1
1.2 Objectives of the Health and Safety Plan	1-2
1.3 Site Background	1-2
1.4 Field Activities for the Work Plan	1-3
1.5 Personnel Requirements	1-3
1.6 Definitions	1-4
 2.0 PERSONNEL AND SITE DOCUMENTATION	 2-1
2.1 Key Personnel	2-1
2.2 Site Visitors	2-1
2.3 Site Safety Officer Duties	2-2
 3.0 HEALTH AND SAFETY HAZARDS	 3-1
3.1 Hazard Analysis for Work Activities	3-1
3.2 Identification of Potentially Hazardous Chemicals	3-2
3.3 Hazard Communication Program	3-5
3.4 Drilling Hazards	3-6
3.5 Well Sampling and Measurement Hazards	3-7
3.6 Marine Safety	3-9
3.7 Confined Spaces	3-13
3.8 Unanticipated Hazards	3-13
3.9 General Safety Procedures	3-14
3.10 Illumination Hazards	3-15
3.11 Biological Hazards	3-15
3.12 Lyme Disease Prevention	3-16
3.13 Poison Ivy, Oak, and Sumac Prevention	3-16
3.13.1 Signs and Symptoms	3-17
3.13.2 First Aid	3-17
3.14 Procedures for Temperature-Related Problems	3-17
3.14.1 Heat Related Illness	3-17
3.14.2 Worker Monitoring for Heat Related Illness	3-19
3.14.3 Cold Related Illness	3-21

TABLE OF CONTENTS (CONTINUED)

Page No.

4.0	PERSONNEL TRAINING REQUIREMENTS	4-1
4.1	Training	4-1
4.2	Training and Briefing Topics for Site Activities.....	4-1
5.0	PERSONAL PROTECTIVE EQUIPMENT	5-1
5.1	Personal Protection	5-1
5.2	Levels of Personal Protection	5-1
5.3	Chemical Resistance/Integrity of Protective Material	5-3
5.4	Inspection of Protective Equipment	5-3
5.5	Specific Levels of Protection Planned for the Site	5-4
6.0	MEDICAL SURVEILLANCE REQUIREMENTS	6-1
6.1	General OSHA Requirements	6-1
6.2	Medical Examinations	6-2
6.3	Exposure/Injury/Medical Support.....	6-3
7.0	FREQUENCY AND TYPES OF AIR MONITORING/SAMPLING	7-1
8.0	SITE CONTROL MEASURES	8-1
8.1	General.....	8-1
8.2	Site Security and Site Access	8-1
8.3	Site Communication.....	8-2
8.4	Decontamination Procedures	8-2
8.5	Levels of Decontamination Required for Personnel.....	8-3
9.0	EMERGENCY/DISASTER CONTINGENCY PLAN.....	9-1
9.1	Pre-Emergency Planning	9-1
9.2	Personnel Roles and Lines of Authority	9-1
9.3	Medical Assistance/Emergency Contacts.....	9-1
9.4	Medical Emergency Response	9-2
9.5	Emergency Recognition and Prevention	9-3
9.6	Evacuation Routes and Procedures	9-3
	9.6.1 Work Area Evacuation.....	9-3
	9.6.2 Facility Evacuation.....	9-3
9.7	Incident Reporting.....	9-4

TABLE OF CONTENTS (CONTINUED)

	<u>Page No.</u>
9.8 Emergency Medical Treatment Procedures.....	9-5
9.9 Fire or Explosion.....	9-5
9.10 Spills and Leaks.....	9-6
9.11 Emergency Equipment and Facilities.....	9-6

ATTACHMENTS

Attachment A	Employee Acknowledgement
Attachment B	Site Activity and Site Briefing
Attachment C	Safety Plan Implementation Checklist
Attachment D	Notice of Unsafe Conditions
Attachment E	Environmental Monitoring Documentation

APPENDICES

Appendix A	- Procedures for the Field Operations of PID and MVA
Appendix B	- Decontamination Procedures

LIST OF TABLES

<u>Table No.</u>	<u>Title</u>	<u>Follows Section No.</u>
1-1	List of Work Activities for Brown and Caldwell Personnel	1
3-1	Work Activities, Potential Hazards and Control Measures	3
3-2	Compounds of Interest and Occupational Exposure Limits	3
3-3	Minimum Illumination Intensities	3
3-4	Comparison of Heat Stroke and Heat Exhaustion	3
5-1	Action Levels for Upgrading Personal Protective Equipment	5
5-2	Chemical Protection of Clothing Materials by Generic Class	5
5-3	Sample PPE Inspection Checklist	5
5-4	Glove Materials - Comparative Chemical Resistance	5
9-1	Emergency Contact Phone List	9
9-2	Emergency Recognition and Control Measures	9

LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>	<u>Follows Section No.</u>
1-1	Project Site Location	1
3-1	Heat Index Chart	3
3-2	Wind Chill Chart	3
9-1	Route to Hospital	9

1.0 INTRODUCTION

1.1 SCOPE AND APPLICABILITY OF HEALTH AND SAFETY PLAN

The purpose of this Health and Safety Plan (HASP) is to identify, evaluate, and control potential safety and health hazards and to provide emergency response procedures to incidents that may occur during field operations during the Remedial Investigation (RI) at the LCP Chemicals Inc. Superfund Site located in Linden, New Jersey (EPA ID# NJD079303020). The RI may involve well drilling and installation, soil borings, surface water and sediment sampling, water level measurements, groundwater sampling, site survey/site reconnaissance, and investigation derived waste sampling at the LCP Superfund Site located at the foot of South Wood Avenue in Linden, New Jersey. This HASP covers only those Brown and Caldwell personnel who are working at the site and who have potential for exposure to hazardous waste, hazardous substances, contaminated groundwater, or a combination of these materials.

This HASP complies with the standards of the Occupational Safety and Health Administration (OSHA) as stated in 29 CFR with emphasis on subsections:

- 1910.120 (Hazardous Waste Operations and Emergency Response),
- 1910.1000 (Toxic and Hazardous Air Contaminants),
- 1910.1200 (Hazard Communication, Employee Right-to-Know Law),
- 1904 (Recording and Reporting Occupational Injuries and Illnesses),
- 1990 (Identification and Regulation of Potential Occupational Carcinogens),
- 1926 (Safety and Health Regulations for Construction); and other applicable federal and state statutes or regulations.

Amendments to this Plan will be made as the contaminant profile information is updated, a change in work status or task is made, or as regulatory requirements dictate. Changes to this Plan will be brought to the attention of people covered under the Plan through additional training and appropriate notification as required.

1.2 OBJECTIVES OF THE HEALTH AND SAFETY PLAN

The objectives of this HASP include the following:

- Identify and evaluate potential work site hazards.
- Identify key personnel and emergency response contacts.
- Define work activities and match personal protection equipment to tasks.
- Establish secure work zones to minimize the spread of contaminants.
- Establish and document air monitoring procedures.
- Implement standard operation procedures to protect workers.
- Provide emergency response procedures.
- Confirm personnel medical monitoring.
- Confirm current HAZWOPER personnel training.
- Provide and implement decontamination procedures.
- Provide appropriate documentation for confined space entry and waste disposal.

1.3 SITE BACKGROUND

ISP Environmental Services, Inc. (ISP-ESI) has been identified by the USEPA as a Potentially Responsible Party (PRP) at the LCP Chemicals, Inc. (LCP) Superfund site in Linden, New Jersey. The site is located immediately adjacent to the ISP-ESI Linden, New Jersey, site and is also bordered by Northville Industries, BP Corporation, and Exxon/Mobil.

The site was originally owned by E.I. duPont de Nemours and Company and was purchased by GAF Corporation (GAF), a predecessor to ISP in 1949. GAF sold the property to LCP in 1972 and production ceased at the site in 1985. Chlorine and sodium hydroxide were produced at the site using the mercury cell electrolysis process. Sludge containing mercury was placed in a brine sludge lagoon.

Various investigations at the site identified the presence of mercury at elevated levels in soils, and adjacent surface waters and sediments. In addition to mercury, relatively low levels of

other organics have also been detected including PCBs, chloroform, benzene, chlorobenzene, dichlorobenzenes, hexachlorobenzene, and naphthalene.

The site was included on the National Priorities List (NPL) on July 27, 1998 and a Consent Order was signed by ISP-ESI in May 1999. Under terms of the Consent Order, ISP-ESI must conduct a Remedial Investigation/Feasibility Study (RI/FS). The RI/FS must be conducted in conformance with the Statement of Work (SOW) identified in the Consent Order. A work plan to conduct the RI/FS was prepared by ISP-ESI and subsequently verbally approved by USEPA.

1.4 FIELD ACTIVITIES FOR THE WORK PLAN

The activities to be covered by the HASP have been identified and are discussed in detail in the Work Plan. The work has been divided into individual field activities as summarized on Table 1-1 with additional details described in Section 3.0, Health and Safety Hazards.

1.5 PERSONNEL REQUIREMENTS

To promote safe work practices, no inherently hazardous activity will be conducted by an individual employee working alone. At least one Brown and Caldwell employee and an employee of the drilling company will be present at the site during intrusive field activities such as well drilling and installation. During typical work activities, such as water level monitoring and groundwater sampling, the buddy system is suggested, but not required.

Best Management Practices require the wearing of safety glasses with side shields by personnel in site areas with the exception of the parking areas. Hard hats may also be required at certain times in designated areas. Designated areas and times that require the use of hardhats will be decided by the Site Safety Officer (SSO), and discussed in a site safety meeting. As a minimum, a monthly site safety meeting will be conducted to address current site conditions and operations which effect site personnel. Daily site meetings will be held

on an as needed basis to discuss changes in work or Personal Protective Equipment (PPE), and accidents that may have occurred during the previous day will be discussed and prevention methods implemented.

1.6 DEFINITIONS

The following terms have been described in the HASP:

- **"Authorized Personnel"** - Any person, such as task-specific personnel, project personnel, oversight personnel, contractors, and consultants whose presence is authorized at the project site by ISP-ESI.
- **"Contractor/Consultant"** - Any person or firm, retained or hired by ISP-ESI, to carry out and/or supervise portions of the activities conducted at the Project Site.
- **"Exclusion Zone"** - The area in which all entering personnel must be directly involved in the ongoing work, have designated personal protective equipment (PPE), and meet training and medical monitoring requirements. This includes activity that disturbs the surface soils, groundwater, or surface water at this site. The exclusion zone will be defined by an approximate 25-foot radius around the work area, which will be suitably marked.
- **"MSDS"** - Material Safety Data Sheet, which provides information on the physical, chemical, and hazardous properties of chemical compounds and formulations. These may include chemical reagents and other products to be brought on the site by Brown and Caldwell personnel, by authorized contractors, and/or the constituents of concern that are present at the site.
- **"Oversight Personnel"** - Any person designated by the state government, federal government, or ISP-ESI who is assigned to carry out oversight work. Oversight personnel must comply with the requirements of this HASP.

- "ppm" - Parts per million; expressed as PPM(v) for gases and vapors.
- "Project Director" - is responsible for the overall direction and completion of the project.
- "Project Health and Safety Manager" - The designated person responsible for the overall content, proper implementation, and maintenance of this site HASP. This person is also responsible for the identification of hazards, which are not discussed in the Plan. Upon major changes in planned activities, the Project Health and Safety Manager shall evaluate the effectiveness of the PPE program for the site and for the planned activities. This shall include reviewing the site inspection notes, employee use and decontamination of PPE, review of site air monitoring and calibration data, and consideration of possible PPE program modifications. This report shall be made available to site personnel.
- "Project Manager" - is responsible for the direction and coordination of the field activities.
- "Project Personnel" - Any person or contractor, assigned by ISP-ESI, its consultants, or its contractors to carry out work at the Project Site (e.g., Project Director, Project Manager, etc.).
- "Project Site" - The area defined by a specific project Work Plan, as well as contiguous areas to which access is required for the execution of the field tasks which may be set forth in a Work Plan.
- "Secure Zone" - The area within a radius of approximately 50 feet established from the center of the work area (e.g., drilling site) and indicated by a visible surface device. Personnel entering a secure zone must have the designated PPE and meet the training and medical monitoring requirements.

- **"Site Safety Officer"** - The person(s) designated by ISP-ESI or the Contractor/Consultant who is responsible for supervising the HASP. This person is responsible for conveying the information contained in the HASP to the workers present on site, and in the absence of the Project Health and Safety Manager from the site, will fulfill the obligations of the Project Health and Safety Manager. This includes attendance at Site Safety meetings, conducting site training and orientation sessions, reporting incidents which happen to personnel under his/her supervision, the timely submission of required forms, and selection of proper PPE, if the need arises to make changes.
- **"Site Safety Officer (Alternate)"** - is responsible for fulfilling health and safety duties in the absence of the Site Safety Officer.
- **"Support Zone"** - The appropriate location, outside of the exclusion zone, for a command post. This area will be used as a medical station, equipment and supply location, and for other administrative or support functions necessary for efficient operations at the site. Any potential contaminated equipment or clothing must remain outside of the support zone. Periodic monitoring should be conducted to ensure that this area remains free from contamination.
- **"Task-Specific Site Personnel"** - Any person or contractor assigned by ISP-ESI and/or its consultants/contractors to carry out work at the project site.

TABLE 1-1

LIST OF WORK ACTIVITIES FOR BROWN AND CALDWELL PERSONNEL
AT THE LCP CHEMICALS, INC. SUPERFUND SITE
LINDEN, NJ

-
1. Concrete Drilling
 2. Surficial Soil Samples
 3. Soil Borings
 4. Monitoring Well Installation
 5. Monitoring Well Decommissioning
 6. Sediment Samples
 7. Surface Water Samples
 8. Tide Investigation
 9. Groundwater Sample Collection
 10. Hydraulic Conductivity Tests
 11. Site Storage Tank Survey
 12. Site Building Reconnaissance
 13. Fence Installation
-

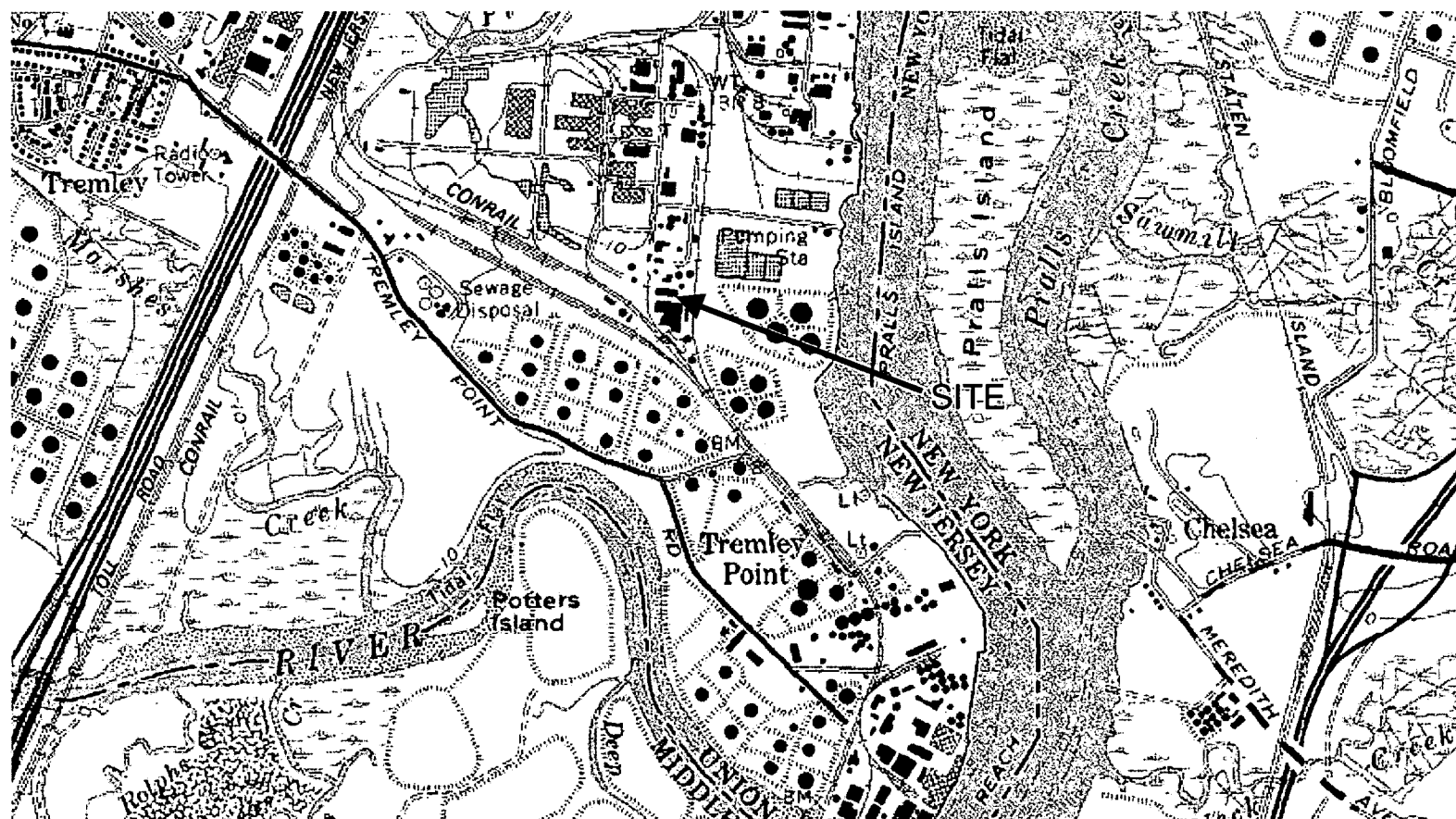


FIGURE 1-1

SITE LOCATION MAP

LCP CHEMICALS INC. SUPERFUND SITE
LINDEN, NEW JERSEY

BROWN AND CALDWELL

2.0 PERSONNEL AND SITE DOCUMENTATION

2.1 KEY PERSONNEL

The Brown and Caldwell Project Health and Safety Director for this project will be Anne Baptiste. In this capacity, Ms. Baptiste will oversee compliance with applicable health and safety regulations. Under Ms. Baptiste's direction, day-to-day site safety activities will be overseen by Ms. Cynthia Doughty and Ms. Jen Potter who will function as the Site Safety Officers. Safety is affected by the actions of involved parties or organizations. For this reason, the following list of key personnel from Brown and Caldwell and ISP-ESI have been identified.

	Personnel	Phone Number (ext.)	E-mail
Brown and Caldwell			
Principal in Charge	Bob Mutch	201-818-6056 (226)	bmutch@brwncald.com
Project Manager	Scott MacMillin	201-818-6056 (211)	smacmillin@brwncald.com
Project H&S Director	Anne Baptiste	619-641-5134 (800) 608-9495 (mobile)	abaptiste@brwncald.com
Site Safety Officers	Cynthia Doughty	201-818-6056 (201)	cdoughty@brwncald.com
	Jennifer Potter	201-818-6056 (280)	jpotter@brwncald.com
Alternate Safety Officer	Steve Hinton	201-818-6056 (238)	shinton@brwncald.com
ISP-ESI			
Project Coordinator	Carrie McGowan, ISP-ESI	973-628-3907	cmcgowan@ispcorp.com
Site Contact/Coordinator	Vince Quilban, ISP-ESI, Linden	908-474-5101	vquilban@ispcorp.com
Alt. Site Contact	John Vandersteen ISP-ESI, Linden	908-474-5101	none

Description of personnel functions and responsibilities are previously defined in Section 1.6.

2.2 SITE VISITORS

First time visitors to the site must receive site orientation from the Site Safety Officer prior to entering the site. Orientation must include identification of restricted areas such as

Exclusion Zones and active operations, site emergency procedures and equipment, emergency phone numbers, and directions to the local hospital.

Visitors and contractor personnel whose work activities require entry into the Exclusion Zone must acknowledge their understanding of this HASP. In addition, these contractors must comply with the general requirements found in "Personnel Training Requirements" (Section 4.0), "Personal Protective Equipment" (Section 5.0), "Medical Surveillance Requirements" (Section 6.0), and "Site Control Measures" (Section 8.0) of this HASP.

Personnel entering the site are required to acknowledge reading this Health and Safety Plan (Attachment A), and to adhere to the Plan requirements while in the vicinity.

2.3 SITE SAFETY OFFICER DUTIES

On a daily basis during field operations, the Site Safety Officer shall visually inspect site activities for compliance with this HASP. Appropriate information of this inspection shall be noted on the Site Activity and Site Briefing log (Attachment B), the Implementation Checklist (Attachment C), and the Environmental Monitoring Documentation (Attachment E). Deficiencies in compliance will be corrected as soon as practical. The corrective action taken shall be noted on Health and Safety Site Daily Log as well as when the corrective action is completed. The following items further define the responsibilities of the Site Safety Officer:

- Complete the Health and Safety Site Daily Log. Note deviations from the site HASP in the Health and Safety Site Daily Log, record why deviations occurred, and record follow-up action(s) taken.
- Verify visitor training and medical clearance records for those visitors and contractor personnel conducting site field activities. Visitors or contractors must complete the Employee Acknowledgment form indicating their understanding of the key elements of the site HASP.

- Provide site visitors with a safety orientation to include an overview of safety procedures, active operations in restricted areas, required personal protective equipment, location of emergency equipment, and the site emergency procedures. First-time visitors to the site must be accompanied by the Site Safety Officer.
- The Site Safety Officer shall interpret the basic requirements of the HASP and request non-compliant visitors to leave the site as applicable.

3.0 HEALTH AND SAFETY HAZARDS

3.1 HAZARD ANALYSIS FOR WORK ACTIVITIES

A hazard analysis for each identified Brown and Caldwell work activity covered by this HASP can be found in Table 3-1. This table provides a summary of anticipated task activities for this site, associated task hazards, and protective measures to be followed to reduce the hazard potential. This table will be updated by the Project Safety and Health Manager as job activities change.

Precautions will be taken to avoid the following common work place hazards:

- Slips, Trips and Falls
- Electrical
- Mechanical
- Fire/Explosion
- Heat and Cold Stress
- Noise (Acoustical)

The Site Safety Officer will evaluate these potential hazards during site inspections. Routine and potential equipment hazards will be discussed during site safety meetings. Workers will be advised of known potential hazards at the site prior to beginning work, and, as required, if site conditions change. Equipment will be operated by trained personnel and employees will be cautioned during site safety meetings to be aware of moving equipment. Employees should be encouraged to be observant of site safety and health hazards, to watch out for other workers, and to report unsafe conditions to their supervisors and the Site Safety Officer.

Safety glasses with side shields, steel-toed boots, coveralls, hearing protection and hard hats will be required to be worn at certain times in designated areas. Fire extinguishers,

respirators, first aid kits, and eyewash stations will be available for use as needed in the work area. Site workers will be trained in their use prior to arrival on site and visitors will be advised of their availability and location.

3.2 IDENTIFICATION OF POTENTIALLY HAZARDOUS CHEMICALS

Potentially hazardous chemicals present in the various site media including; soils, sediment, surface water and groundwater have been previously determined during earlier investigations. These primarily include mercury, however, relatively low levels of other organic constituents have also been detected including PCBs, chloroform, benzene, chlorobenzene, dichlorobenzenes, hexachlorobenzene, and naphthalene. The potential routes of exposure to these site media include:

- Inhalation of vapors or dusts from the site materials.
- Direct dermal (skin) contact or absorption of contaminants contained in the site media.
- Ingestion by hand-to-mouth transfer of contaminants.

The available data reveal that the primary chemical constituent known to exist at the site is mercury. The mercury is known to exist in the metallic form. It is unknown whether mercury also exists in other forms including inorganic mercury compounds and/or methyl mercury.

Table 3-2 presents the chemicals of interest and their current occupational exposure levels. The Permissible Exposure Limits (PEL) established by the Occupational Safety and Health Administration (OSHA) reflect both the vacated final rule values of 1993 as well as the less stringent values found in the earlier Air Contaminants Standard (29 CFR 1910.1000). The Recommended Exposure Limits (REL) were from the 1994 edition published by the National Institute for Occupational Safety and Health (NIOSH), and the Threshold Limit Values (TLV) published by the American Conference of Governmental Industrial Hygienists

(ACGIH) are from the latest edition. Each occupational exposure limit is based upon known and available medical, biological, engineering, chemical, trade, and other relevant information to reduce or eliminate the adverse health and safety effects of these chemicals. Additional chemical information on site constituents can be found in the NIOSH Pocket Guide to Chemical Hazards as well as in generic Material Safety Data Sheets (MSDS). Additional information regarding the chemicals of interest are presented as follows:

Mercury - At room temperature mercury is a liquid. It does have sufficient vapor pressure to volatilize at room temperature which may lead to personal exposure to mercury vapor. Acute poisoning due to mercury vapors affects the lungs primarily in the form of acute interstitial pneumonitis, bronchitis, and bronchiolitis. Exposures to lower levels over prolonged periods produces symptoms that vary from individual to individual. Four classic signs that are rarely seen together include: gingivitis, gastrointestinal distress, increased irritability and muscular tremors. The primary health effect due to chronic exposure to mercury vapor is damage to the central nervous system. It is irritating to the eyes and skin on contact.

To present a health hazard, mercury must be in such a form as to gain entrance into the body or tissue in measurable quantities. The primary mode of entry, that is of concern, is inhalation of mercury fume, and secondary, is ingestion if poor personal hygiene is practiced. Mercury is a cumulative poison. It is stored in the body and acts as a cellular poison to organ systems before symptoms and disability is evident. Mercury poisoning damages organs and tissues of the body such as kidneys, liver, blood vessels, nervous system and reproductive organs. Chemical and physical properties may vary depending upon the specific mercury compound. Mercury has an airborne permissible exposure level (PEL) of 0.10 mg/m³ and a TLV if 0.025 mg/m³. The immediately dangerous to life and health level (IDLH) of 10 mg/m³ has been established.

PCBs - PCBs are colorless to light yellow, viscous liquids (above 50°F) that can be detected by their mild hydrocarbon odor. PCBs are non-flammable but are strong oxidants. The routes of exposure for PCBs are inhalation, ingestion, and skin and eye contact leading to absorption. PCBs exposure is known to target the skin, eyes and liver. The primary effect

of exposure to PCBs is a type of dermatitis known as chloracne associated with skin contact. The current PELs for PCBs are 0.5 Mg/m³ and 1.0 Mg/m³ for 54% chlorine and 42% chlorine substitution, respectively. These compounds are suspected carcinogens based on animal studies.

Chlorobenzene - Chlorobenzene is a colorless flammable liquid with an almond-like odor. It is incompatible with strong oxidizers. Routes of exposure are inhalation, ingestion, skin and/or eye contact. Symptoms include irritation of eyes, skin, nose; drowsiness, uncoordination; and central nervous system depressant/depression.

1,2-Dichlorobenzene (o-Dichlorobenzene) - 1,2-Dichlorobenzene is a colorless to pale-yellow combustible liquid with a pleasant, aromatic odor. It reacts with strong oxidizers, aluminum, chlorides, acids, and acid fumes. Exposure routes include inhalation, skin absorption, ingestion, skin and/or eye contact. The vapor irritates the eyes, the skin and the respiratory tract. The liquid, left on the skin may produce blistering. The substance may cause effects on the central nervous system. Exposure could cause lowering of consciousness.

1,3-Dichlorobenzene (m-Dichlorobenzene) - 1,3-Dichlorobenzene is a combustible liquid that reacts with oxidizing agents, aluminum, and its alloys). Exposure routes include inhalation, skin absorption, ingestion, skin and/or eye contact. The vapor irritates the eyes, the skin and the respiratory tract.

1,4-Dichlorobenzene (p-Dichlorobenzene) - 1,4-Dichlorobenzene is a colorless or white crystalline solid with a mothball-like odor. It is a combustible solid, but it may take some effort to ignite. It is incompatible with strong oxidizers (such as chlorine or permanganate). Routes of exposure include inhalation, skin absorption, ingestion, skin and/or eye contact. Symptoms of exposure include eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury. It is considered a potential occupational carcinogen.

Hazard Prevention

For inhalation, prevention of exposure is accomplished by appropriate dust and vapor control measures and/or through the appropriate use of air-purifying or air-supplying respirators. For direct dermal contact or absorption, prevention of exposure is accomplished by the proper selection and use of protective clothing. For ingestion, prevention is accomplished through good hygiene practices, frequent hand washing, and enforcement of site rules regarding eating, drinking, and smoking restrictions.

Site personnel will receive training about the potential chemical risks from the compounds known to be present at the site. Appropriate site controls and PPE will be utilized to further reduce potential chemical exposure.

3.3 HAZARD COMMUNICATION PROGRAM

The OSHA Hazard Communication (Haz-Com) Standard found in 29 CFR 1910.1200, requires that hazard information on workplace chemicals be communicated to workers present at a site. The Project Health and Safety Manager shall be responsible for the development and administration of the site Haz-Com program which includes the written program, a warning label system, MSDS information, and employee training.

MSDS information on calibration and decontamination chemicals brought to the site by Brown and Caldwell personnel will be maintained on site for review in a separate document.

All contractors must supply Brown and Caldwell with a list of chemicals that they will bring onto the site and the MSDS for each chemical. Contractors must also apply labels on chemical containers brought into the work place. When contractors are finished working at the site, they must either dispose of or take with them unused chemicals brought onto the site.

3.4 DRILLING HAZARDS

Physical hazards that may generally be associated with drilling operations include the following:

- Noise levels exceeding the OSHA action level of 85 dBA may be a hazard and limit personnel communication. Noise levels exceeding the OSHA PEL of 90 dBA, may cause permanent hearing loss.
- Carbon monoxide fumes from the drilling rig.
- Overhead utility wires may present an electrical hazard both from direct contact and from arcing when the drill rig boom is in the upright position.
- Underground utility services may be ruptured or damaged during active drilling operations.
- Moving parts on the drill rig such as augers and catheads may catch loose clothing. In addition, free or falling parts from the drill rig may cause head injury. Moving parts may throw materials resulting in eye injuries.
- Movement of heavy equipment over uneven terrain may cause the rig to roll over or become stuck in a rut.
- High-pressure hydraulic lines and airlines used on the drill rig may pose a hazard should they be incorrectly assembled or poorly maintained.

Hazard Prevention

- "Kill switches" will be tested daily and after repairs have been made to the drill rig. All personnel will be familiar with the location and operation of "kill switches".

- Drillers will inspect daily the chains, hydraulic lines, cables, catheads, etc. for weak spots, frays, and other associated problems.
- Approved ear muffs and earplugs will be used to reduce noise levels below the OSHA action level of 85 dBA. If you have difficulty in maintaining normal conversation levels, the site noise level likely exceeds the safe OSHA limit, and hearing protection must be worn. These situations could include, but are not limited to, equipment operators, hand tool use, treatment system operation, and pumping activities.
- Hardhats must be worn at all times when working in a Secure Zone during drilling operations. Loose clothing will be secured, and the clearances will be checked prior to approaching the drill rig.
- The boom on the drill rig will be lowered to avoid contacting overhead lines. Overhead utilities will be considered "live" until determined otherwise. The rig mast will not be raised within 20 feet of an overhead electrical line until the line is de-energized, grounded, or shielded. The boom will also be lowered when moving the drilling rig. If it becomes necessary to de-energize a power line, the SSO will notify site workers when it has been de-energized upon notification from the Utility Company.
- An underground utilities search will be conducted before the commencement of a drilling project. Copies of relevant information (maps etc.) will be provided to site workers after completion of a utilities search.
- Hydraulic lines will be checked prior to and during use.

3.5 WELL SAMPLING AND MEASUREMENT HAZARDS

Potential hazards associated with well sampling and measurement are listed below:

- Potential exposure to volatile organic vapors (VOCs) when opening the wellhead.
- Back strain due to lifting bailers or pumps from down-well depths and moving equipment to well locations.
- Slip and fall potential from wet, muddy, or snow-covered surfaces created by spilled water or inclement weather.
- Electrical hazards associated with the use of electrical equipment around water or wet surfaces.
- Splash potential from groundwater into the eyes during sampling.
- Potential exposure to sample preservatives and decontamination chemicals.

Hazard Prevention

- To minimize the potential of exposure to VOCs when initially opening the wellhead, an air-monitoring device (Photo Ionization Device (PID)) should be placed near the opening. The area of the breathing zone will also be monitored. Adequate protective clothing will be provided to prevent dermal contact with the groundwater. PPE, including respiratory protection, shall be assigned and utilized as needed depending on the results of the air monitoring and action levels established in this HASP.
- Back strain can be prevented by employing proper lifting and bailing techniques. Heavy equipment will be lifted using proper lifting procedures. Lift with the legs, and when needed, get the help of others.
- Slipping on wet surfaces will be prevented by placing purged water in drums for removal. A boot with a good tread for traction will be used to minimize the potential of slipping.

- Ground fault interrupters will be used when pumps are operated in or around wet conditions.
- Appropriate eye protection will be worn to prevent water splashing into the eyes. At a minimum, safety glasses with side shields are required to be worn at all times. If there is a high potential for liquid splashes, goggles must be worn.
- Gloves and other PPE should be worn, as required, to prevent contact with preservative and decontamination chemicals.

3.6 MARINE SAFETY

This Operating Procedure establishes guidelines for the safe operation of watercraft during BC field activities such as biological sampling, sediment sampling, and bathymetry. The Coast Guard and individual states have additional specific requirements. This Operating Procedure is intended to apply to the operation of Class A and Class 1 boats.

Definitions

Class A - A boat less than 16 feet long. Class A has the greatest numbers of boats. They can all be car topped or trailered. Due to their lightness and small size, many can become unstable if weight in them is excessive or carelessly loaded. Too much weight makes these boats sluggish, reduces their freeboard (the height of their sides above water) and can swamp (flood) them.

Class 1 - A motorized boat from 16 feet to less than 26 feet in length. Though heavier and more powerful than Class A craft, most are still trailerable.

Type III Flotation Aid - Generally the most comfortable, have at least 15.5 pounds of buoyancy in the adult size. They do not turn the wearer face-up and can be jackets or vests.

Type IV Throwable Devices - Include the horseshoe, rung, and cushion. They have at least 16.5 pounds of buoyancy and must offer immediate access.

Boarding Small Boats

Be sure that the boat is secure. With one hand on the boat, quickly lower yourself straight down into the center of the boat. A life preserver should be worn. If others are boarding, have them step along the fore-and-aft centerline of the boat while you hold the boat in place along the pier. Avoid carrying anything aboard. Step down into the boat and load the items off the pier, or have someone hand them to you one by one.

Loading of Boats

Amount and location of weight (persons and gear: the movable ballast) is critical for capsize protection. In a small utility boat, keep weight toward the middle, both fore-and-aft and side-to-side. If you see waves approaching, take them on the bow. Overloading a small boat inhibits its ability to rise to oncoming waves. Less freeboard means less clearance above the water's surface to prevent swamping. All craft must be operated within the boat manufacturers weight limits.

Boat Safety Equipment For BC-Operated Class A and Class 1 Boats

- All persons on the boat will wear a U.S. Coast Guard approved Type III personal flotation vest. The Type II vests (typically orange chest type) are not recommended because they are difficult to work in. In addition, throwable Type IV devices will be readily available for use.
- At least one 1A-10BC Type U.S. Coast Guard approved hand-held portable fire extinguisher will be on the boat, readily available for use.
- Visual Distress Signal Flares and a battery operated light will be in good working order and readily available on the boat.

- A sound-producing distress signal, either bell, whistle, or horn, will be in good working order and readily available on the boat.
- A first aid kit will be available on the boat.
- All boat fuel (gasoline) will be contained in engine manufacturer's approved containers that supply fuel to the engine via neoprene fuel lines. No fuel transfers between containers are to be conducted aboard the boat.
- A secondary means of propulsion will be available on the boat (oars or paddle).
- A boat hook, anchors, and proper mooring lines will be available on the boat.

Safe Boating Operations

- All boats will be properly registered for use in waterways of local, state, and federal jurisdictions.
- All boat trailers and towing vehicles will be properly licensed and in good working order.
- The boat will only be operated by experienced personnel. The U.S. Coast Guard Auxiliary and other organizations regularly sponsor boating safety courses. In addition to basic boating safety, the courses cover navigation regulations and emergency procedures. The training is recommended, even for experienced boat operators.
- The boat will be operated in a safe manner and all waterway regulations will be obeyed.

- No smoking or alcoholic beverages are permitted on the boat.
- No recreational equipment for fishing, hunting, water skiing, or SCUBA diving will be allowed on the boat unless specifically authorized as part of the work-related equipment.

Crew Requirements

- 1 In the following circumstances a qualified employee shall be assigned to assist with deck duties:
 - when extended trips including overnight trips are made from the work site,
 - when conditions of navigation make it hazardous for an operator to leave the wheel while underway,
 - when operations being performed, other than tying-in, require the handling of lines,
 - when operating at night or during inclement weather, or
 - when towing.
- 2 A qualified employee is any individual who has established to the satisfaction of the operator of the vessel, that he/she is physically and mentally capable of adequately performing the deck duties to which he/she may be assigned.

Boating Accidents

Coast Guard regulations, as well as state regulations, require accident reports if significant injuries or property damage occurs. It is normally best to stay with the boat in case of an accident and use signal flares or a distress horn to summon help. Hypothermia (cold stress) is a significant risk for those involved in boating accidents due to the rapid conduction of body heat by cold water. Wet or dry suits are recommended for cold weather/cold water operations.

3.7 CONFINED SPACES

Entry by Brown and Caldwell employees or contractors into confined spaces are not authorized under this HASP unless they receive prior clearance from the Project Health and Safety Manager who will provide instruction in completing a Confined Space Entry permit, required air monitoring, and other details as required under the Brown and Caldwell Confined Space Entry program.

Confined spaces are defined as a work area or space that is so configured that an employee can bodily enter, is not designed or intended for continuous employee occupancy, and has a limited means of entrance and exit. A confined space provides the potential for poor natural ventilation which may result in possibly high concentrations of contaminants, low oxygen levels, explosive atmospheres, limited visibility, and restricted movement. Confined space entries by Brown and Caldwell personnel or contractors are not authorized nor anticipated under this HASP.

Confined spaces at this site include the following:

- Any site excavations;
- Tanks and wells, and;
- All manholes.

Confined spaces must be identified with a posted sign that states "Caution - Confined Space" or other similar warning.

3.8 UNANTICIPATED HAZARDS

The following conditions, situations, or activities are not anticipated at this site and, therefore, safety procedures appropriate to them are not included in this Plan. If these items are encountered or discovered, the Site Safety Officer will immediately contact Brown and

Caldwell's Project Health and Safety Manager to define a response. Work in this area must stop until a response is received.

- The need to handle, open, sample, or ship drums or containers of hazardous substances (other than the samples to be collected as identified in the Project Work Plan).
- The need to handle, enter, open, sample, or ship tanks or vaults containing hazardous substances.
- Activities requiring personal protective equipment more extensive than Level C as described in Section 5.0.

3.9 GENERAL SAFETY PROCEDURES

The following general safety rules must be followed by project personnel:

- Safety equipment and protective clothing will be worn at all times in Exclusion Zones, by all persons, in conformance with this Plan and the requirements of 29 CFR 1910.120.
- Unnecessary contact with contaminated surfaces or with surfaces suspected of being contaminated should be avoided.
- Eating, drinking, chewing gum or tobacco, smoking, or such practices that increase the probability of hand-to-mouth transfer and ingestion of material is prohibited in secure or exclusion zones.
- Certain medicines and alcohol can increase the toxic effects of chemicals. Personnel who must be on medication during potential exposure situations must advise the Project Health and Safety Manager prior to beginning work on site. All

medical information will be made available to emergency medical personnel in the case of an emergency.

- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or other activities.
- Personnel should shower as soon as possible after the protective clothing is removed and the activity for the day has been terminated.

3.10 ILLUMINATION HAZARDS

Fieldwork in non-illuminated areas should not occur during periods of darkness. If situations require working in the dark, illumination should be provided according to levels specified in Table 3-3 for work areas in 29 CFR 1910.120(m), Table H-102.1. An illumination meter can be purchased or rented for the purpose to measure illumination intensities in specific areas.

3.11 BIOLOGICAL HAZARDS

The potential to encounter various reptiles, insects, and poison ivy in the course of completing the work plan covered by this HASP is considered highly probable. The geographic location, the climate, the biota, and the location of the site tend towards the creation of a suitable habitat for snakes, insects, and poison ivy. Precautions will be taken by all on site personnel to avoid prime snake and insect habitats, to protect oneself, and assist other personnel from attack or encounter. (Note: An encounter with a poisonous snake requires immediate professional medical attention.)

Ants, bees, and wasps are considered to be the most common insects that may be encountered. Although their bite is not considered life threatening, an allergic reaction to these bites could occur. Avoid insect habitats whenever possible.

If bitten by insects, remove the stinger by gently scraping it out (do not use tweezers). Apply ice to the affected area. Instant ice packs are to be kept in the work area. If the worker is bitten by an insect, immediately apply an ice pack to the affected area and wash area with soap, apply antiseptic. If an allergic reaction occurs, transport worker to the closest medical facility for treatment.

3.12 LYME DISEASE PREVENTION

The prevention of Lyme Disease is important during spring, summer and fall months. Lyme Disease is a bacterial infection transmitted by the bite of a deer tick. About 50 percent of deer ticks carry the Lyme Disease bacteria.

To prevent the bite of a deer tick, avoid grassy areas when possible. Wear protective clothing (light colored) with long sleeves and pants tucked inside of socks. Use repellent containing "Permethrin" or "Deet". These repellents should be applied to clothing and not directly on the skin. Make self-inspection a habit following exposure to an area which may contain deer ticks.

- *Symptoms:* headache, flu-like symptoms, a spreading ring-like rash, swelling and pain of the joints.
- *Tick Removal:* Remove attached tick immediately. Use tweezers to grasp the tick's head, near the skin, and slowly pull straight out. If possible, save the tick for laboratory analysis.

Report incidents involving deer tick bites to Brown and Caldwell's Project Health and Safety Manager.

3.13 POISON IVY, OAK, AND SUMAC PREVENTION

Poison ivy may be encountered in the grassy/wooded areas on this site. Precautions include wearing gloves when clearing brush and staying on pathways when possible. Poison ivy,

oak, and sumac plants cause contact dermatitis or an allergic reaction in about 90 percent of all adults. To prevent contact, wear protective clothing (Tyvek, long sleeves, gloves). Remove clothing without touching the outside of the garments that may have come in contact with the plants.

3.13.1 Signs and Symptoms

- Mild reaction: some itching.
- Mild to moderate reaction: itching and redness.
- Moderate reaction: itching, redness, and swelling.
- Severe: itching, redness, swelling, and blisters.

A day or two is the usual time between contact and the onset of symptoms.

3.13.2 First Aid

Those knowing that they have had contact with a poisonous plant should take immediate action within five minutes. The action includes rinsing with brown soap and water or using alcohol. During the acute or weeping and oozing stage, sodium bicarbonate (baking soda) solution should be used.

If symptoms are severe, contact the Project Health and Safety Manager for instructions for treatment by a physician.

3.14 PROCEDURES FOR TEMPERATURE-RELATED PROBLEMS

3.14.1 Heat Related Illness

When coveralls made of Tyvek or Saranex are worn, body ventilation and evaporation are greatly reduced. Frequent breaks will be scheduled for personnel wearing coveralls during hot or humid conditions as noted in the Heat Index Chart in Figure 3-1. Employees will be advised of the effects of heat stress, be provided with adequate drinking water while on site,

and be instructed to observe each other for signs of heat stress during hot weather. Acute heat stress signs are summarized in Table 3-4 and below.

- **Heat Exhaustion** - Acute reaction to heat exposure with symptoms of weakness, dizziness, fainting, nausea, headache, cool and clammy skin, profuse sweating, slurred speech, weak pulse, and dilated pupils.

First Aid Treatment includes moving patient to a cool place, loosen clothing, and place them in a head-low position.

- **Heat Stroke** - A life-threatening, dangerous, and acute reaction to heat exposure with failure of the heat-regulating mechanisms of the body. Symptoms include high body temperature, cessation of sweating, dry skin, headache, numbness, tingling, confusion, fast pulse, rapid and loud breathing, convulsion, and unconsciousness leading into coma.

First Aid Treatment requires the evacuation and removal of the patient to the Support Area, removal of protective clothing, followed by the rapid cool down of the patient in cold water, with the head and shoulders slightly elevated. Heat stroke is a medical emergency. If anyone shows signs of heat stroke, immediately take emergency precautions, contact medical personnel, and transport them to a medical facility as soon as possible (refer to emergency numbers and hospital route in Section 9.4).

These signs can be distinguished from those associated with chemical hazards which are characterized by behavioral changes, breathing difficulties, change in complexion or skin color, coordination difficulties, coughing, dizziness, drooling, diarrhea, fatigue or weakness, and irritability.

3.14.2 Worker Monitoring For Heat Related Illness

Monitoring for heat stress per the current ACGIH guidelines will be implemented when the ambient temperature reaches 70°F (21°C) for workers wearing splash resistant clothing (Tyvek or Saranex coveralls).

To monitor the worker, measure:

- *Heart rate.* Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.
- *Oral temperature.* Use a clinical thermometer (three minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period. If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third. Do not allow a worker to wear a semi-permeable or impermeable garment when his/her oral temperature exceeds 100.4°F (38°C).
- *Monitor body water loss*, if possible. Measure weight on a scale accurate to ± 0.25 pound at the beginning and end of each workday to see if enough fluids are being taken to prevent dehydration. Weights should be taken when wearing similar (or lack of) clothing. Daily body water loss should not exceed 1.5 percent of total body weight in a single workday. Also, being thirsty is not a good indicator of potential dehydration.

Fluid replacement should consist primarily of water, fruit juices, and other non-caffeinated beverages. The consumption of alcoholic drinks to replenish lost fluids is not recommended due to its diuretic effect.

Caution should be exercised when working in hot conditions for the first time or following a prolonged break (such as vacations) until your body becomes acclimatized to the hot conditions. NIOSH recommends a progressive six-day acclimatization period to allow people to become accustomed to hot conditions with only 50 percent workload on the first day and an additional 10 percent added each following day.

The frequency of physiological monitoring depends on the ambient air temperature, solar radiation, wind speed, humidity, acclimatization, and the level of physical work activity. These are reflected in the physiological monitoring for the individual work cycles mentioned in the above paragraphs. When semi-permeable, splash resistant clothing is added, the prevention of heat stress through monitoring and work/rest cycles should begin above temperatures of 70°F as noted below.

**SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING and
WORK/REST CYCLES FOR FIT and ACCLIMATIZED WORKERS^a**

Heat Index Temperature ^b	Normal Work Ensemble ^c	Semi-Permeable Clothing
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

^a For work levels of 250 kilocalories/hour (light to moderate work level).

^b Adjust temperature for the effect of sunshine by this equation: Heat Index (ta)°F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

^c A normal work ensemble consists of cotton coveralls or other cotton long sleeve and pants clothing.

Every effort should be established so that the majority of the workday schedule will be completed before the ambient air temperatures reach their highs for the day. Rotation of personnel into jobs requiring the wearing of semi-permeable clothing is also an effective administrative control to reduce the effects of heat stress.

3.14.3 Cold Related Illness

Factors affecting the potential development of cold weather related symptoms include ambient air temperature, wind speed, ambient humidity, perspiration, contact with surface water or metal, clothing, age, and general health conditions. The wind chill index (Figure 3-2) shows the equivalent temperature on exposed flesh resulting from the combined effects of ambient temperature and wind speed. It should be noted that high humidity conditions and cold temperatures also have the effect of rapidly removing heat from the body.

Cold temperature clothing will be provided to Brown and Caldwell personnel required to work in temperatures below 40°F. This clothing may include insulated coveralls, gloves, boots, windbreakers, and hard hat liners. Outer and inner garments will be selected that allows perspiration to be drawn away from the skin.

Work rate should not be so high as to cause heavy sweating when the wind chill index falls below 10°F. If heavy work must be done, arrangements should be made to provide a heated warming shelter for rest periods. Work should also be arranged to minimize sitting or standing still for long periods of time.

Hypothermia is a general term describing the lowering (cooling) of the body core temperature. Initially, blood flow is restricted to the skin, hands, and feet and conserved for the body core and brain. Stages of hypothermia include shivering (a response that generates heat), apathy, decreased muscle function, decreased level of consciousness, a glassy stare, possible freezing of the extremities, and decreased vital signs with slow pulse and slow respiration rate.

Severe hypothermia results in a rapid decline in the body core temperature and is an acute emergency requiring immediate medical attention. Keep the patient as warm and dry as possible until professional medical attention is available.

Frostbite is the effect of freezing a body part such as the ears, cheeks, nose, fingers, or toes. Symptoms are first noticed as local tingling and redness, followed by paleness and numbness. Initial stages are described as frostnip or incipient frostbite, and characterized by sudden blanching or a whitening of the skin. Superficial frostbite is where the skin has a waxy or white appearance and is firm to the touch, but the tissue beneath is resilient. Deep frostbite, is where the tissues are cold, pale, and solid; this is an extremely serious condition that requires immediate medical attention.

First Aid Treatment of frostbite is to gradually warm up the affected body part. If numbness and/or pain does not subside and if deep frostbite is evident, medical attention should be obtained as soon as possible.

Prevention of frostbite can be accomplished through the replacement of wet clothing with dry clothing, drinking of warm fluids in the Support Zone, and frequent warm-up breaks.

Work will be suspended during weather conditions that are sufficiently extreme to potentially affect the adequacy of the HASP or the integrity of equipment, such as heavy rains, heavy snowfall, electrical storms, or extreme heat or cold. The Site Safety Officer is responsible for determining when to suspend work.

TABLE 3-1

WORK ACTIVITIES, POTENTIAL HAZARDS, AND CONTROL MEASURES
LCP Chemicals Inc. Superfund Site, Linden, New Jersey

OPERATOR TASK	POTENTIAL HAZARDS	PROTECTIVE MEASURES
Concrete Drilling	Inhalation of or direct contact with contaminants; noise; injury from rubber tire back-hoe or other equipment; weather related exposure; slips, trips and falls	Modified Level D PPE; air monitoring; trained operators; caution in vicinity of equipment; heat/cold stress training; removal of debris
Well Drilling/Installation Surficial Soil Samples Soil Borings	Inhalation of or direct contact with contaminants; noise; injury from drilling rig or other equipment; weather related exposure; slips, trips and falls	Modified Level D PPE; air monitoring; trained operators; caution in vicinity of equipment; heat/cold stress training; removal of debris
Monitoring Well Decommissioning	Inhalation of or direct contact with contaminants; noise; injury from drilling rig or other equipment; weather related exposure; slips, trips and falls	Modified Level D PPE; air monitoring; trained operators; caution in vicinity of equipment; heat/cold stress training; removal of debris
Surface Water and Sediment Sampling	Inhalation of or direct contact with contaminants; weather related exposure; slips, trips and falls	Modified Level D PPE; air monitoring; heat/cold stress training; removal of debris
Tide Investigation	Inhalation of or direct contact with contaminants; weather related exposure; slips, trips and falls	Modified Level D PPE; air monitoring; heat/cold stress training; removal of debris
Groundwater sampling	Inhalation of or direct contact with contaminants; weather related exposure; lifting stresses; slips, trips and falls	Modified Level D PPE; air monitoring; heat/cold stress training; training in proper lifting procedures; removal of debris
Hydraulic Conductivity Tests	Inhalation of or direct contact with contaminants; weather related exposure; lifting stresses; slips, trips and falls	Modified Level D PPE; air monitoring; heat/cold stress training; training in proper lifting procedures; removal of debris
Site Storage Tank Survey (exterior of tanks)	Inhalation of or direct contact with contaminants; weather related exposure; lifting stresses; slips, trips and falls	Modified Level D PPE; air monitoring; heat/cold stress training; training in proper lifting procedures; removal of debris

TABLE 3-1 (CONTINUED)

WORK ACTIVITIES, POTENTIAL HAZARDS, AND CONTROL MEASURES
LCP Chemicals Inc. Superfund Site, Linden, New Jersey

OPERATOR TASK	POTENTIAL HAZARDS	PROTECTIVE MEASURES
Survey Location Site Reconnaissance	Inhalation of or direct contact with contaminants; weather related exposure; slips, trips and falls	Modified Level D PPE; air monitoring; heat/cold stress training; removal of debris
Fence Construction	Inhalation of or direct contact with contaminants; weather related exposure; lifting stresses; slips, trips and falls	Modified Level D PPE; air monitoring; heat/cold stress training; training in proper lifting procedures; removal of debris

Any physical entrance into vaults or manholes by *any* personnel qualifies as a confined space entry. Such entry shall follow confined space entry procedures which include the use of trained personnel, air monitoring, and established rescue procedures. Entry into these areas by Brown and Caldwell employees are *not authorized* nor anticipated under this HASP.

Table 3-2

**Constituents of Interest and Occupational Exposure Limits
LCP Superfund Site**

Constituent	IP ^a	TLV ^c 8-hour TWA	PEL ^d 8-hour TWA	IDLH ^e Level	Odor Threshold, PPM	Notes ^f	Potential Symptoms of Exposures ^g
Mercury	NA	0.025 mg/m ³	0.1 mg/m ³	10 mg/m ³	NA		Eye and skin irritation, chest pain, dyspnea, headache, fatigue, irritability
Polychlorinated Biphenyls	NA	0.5 mg/m ³	1 mg/m ³	5 mg/m ³		Ca, S, 65	Nausea, lethargy, chloracne, dermal lesions, dec. pulmonary function, hepatic injury
Benzene	9.24	0.5 ppm	1 PPM	500 PPM	4.68	Ca, 65	Irritation to eyes, nose, respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis, bone marrow, depression
Chlorobenzene	9.07	10 ppm	75 PPM	1000 PPM			Irritation to skin, eyes, nose, drowsiness, incoherence
1,2 Dichlorobenzene	9.06	25 ppm	50 ppm C	200 ppm	<15 ppm		Eye and nose irritant, liver and kidney damage, skin blisters
1,3 Dichlorobenzene	9.12	NA	NA	Unknown			Irritates the eyes, the skin and the respiratory tract.
1,4 Dichlorobenzene	8.98	10 ppm	75	Ca	0.12	65, Ca	Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting
Naphthalene	8.12	10 ppm	50 mg/m ³	250 ppm			Eye irritation, excitement, vomiting, dermatitis

^a Ionization potential in electron-volts (eV).

^c Threshold Limit Value as the airborne 8-hour time-weighted average (TWA) established by the American Conference of Governmental Industrial Hygienist (ACGIH), 1999.

^d Permissible Exposure as the airborne 8-hour time-weighted average (TWA) established by the Occupational Safety and Health Administration (OSHA).

^e Immediately Dangerous to Life and Health level as published in the National Institute for Occupational Safety and Health (NIOSH), Pocket Guide to Chemical Hazards, 1994 edition.

^f Hazard category; Ca-Carcinogen; C-Ceiling; S-Skin absorption; 65 – Proposition 65 chemicals known to the State of California to cause cancer or reproductive harm.

^g Sources: NIOSH Pocket Guide to Chemical Hazards, June, 1994; Amdur, Mar O; Doull, John; Klaassen, Curtis, D., Toxicology, The Basic Science of Poisons, fourth Edition, 1993; and Merk & Co. Inc. The Merck Index, 1996.

TABLE 3-3

MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES
29 CFR 1910.120 (M). Table H-102.1

Foot-Candles	Area or Operation
5	General site areas
3	Excavation and waste areas, accessways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exitways
5	Tunnels, shafts, and general underground work areas.
10	General shops (mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms.
30	First aid stations, infirmaries, and offices.

TABLE 3-4

COMPARISON OF HEAT STROKE AND HEAT EXHAUSTION

Heat Stroke (911 - Medical Emergency)		Heat Exhaustion
Definition:	A condition or derangement of the heat-control centers due to exposure to the rays of the sun or very high temperatures. Loss of heat is inadequate or absent.	A state of very definite weakness produced by the excess loss of normal fluids and sodium chloride in the form of sweat.
History:	Exposure to sun or extreme heat	Exposure to heat; person usually works indoors
Differential Symptoms:	<i>Face:</i> Red, dry, and hot <i>Skin:</i> Hot, dry, and <u>no</u> sweating <i>Temperature:</i> High, 106° to 110°F (41.1° to 43.3°C) <i>Pulse:</i> Full, strong, bounding <i>Respirations:</i> Audible, labored, difficult, loud <i>Muscles:</i> Tense and possible convulsions <i>Eyes:</i> Pupils are dilated, but equal	<i>Face:</i> Pale, cool, and moist <i>Skin:</i> Cool, clammy, with <u>profuse</u> sweating <i>Temperature:</i> Subnormal <i>Pulse:</i> Weak, thready, and rapid <i>Respirations:</i> Shallow and quiet <i>Muscles:</i> Tense and contracted <i>Eyes:</i> Pupils are normal; eyeballs may be soft
Treatment:	Absolute rest with head elevated; <u>keep body cool by any means available until hospitalized</u> , but do not use alcohol applied to skin. Take temperature every 10 minutes, and do not allow it to fall below 101°F (38.5°C). <i>Drugs:</i> Allow no stimulants; give infusions of normal saline (to force fluids).	Keep patient quiet; head should be lowered; keep body warm to prevent onset of shock. <i>Drugs:</i> Salty fluids and fruit juices should be given frequently in small amounts. Intravenous isotonic saline will be required if patient is unconscious.

Source: *Taber's Cyclopedic Medical Dictionary*, 17th Edition, 1993.

FIGURE 3-1

HEAT INDEX CHART

	Air Temperature (Degrees F)										
	70	75	80	85	90	95	100	105	110	115	120
Relative Humidity	Heat Index										
0%	64	69	73	78	83	87	91	95	99	103	107
10%	65	70	75	80	85	90	95	100	105	111	116
20%	66	72	77	82	87	93	99	105	112	120	130
30%	67	73	78	84	90	96	104	113	123	135	148
40%	68	74	79	86	93	101	110	123	137	151	
50%	69	75	81	88	96	107	120	135	150		
60%	70	76	82	90	100	114	132	149			
70%	70	77	85	93	106	124	144				
80%	71	78	86	97	113	136	157				
90%	71	79	88	102	122	150	170				
100%	72	80	91	108	133	166					

Heat Index Readings and Potential Heat Related Disorders:

85 to 94 degrees F - Caution: physical activity may cause fatigue

95 to 105 degrees F - Extreme Caution: possible heat cramps and/or heat exhaustion with prolonged exposure

Above 105 degrees F - Danger: possible heat stroke with prolonged exposure; heat exhaustion and heat cramps likely

Source: <http://www.weatherpoint.com/weather/glossary/text/wchill.htm>

**KNOW THESE
Heat Disorders****Symptoms****First Aid**

SUNBURN	Redness and pain. In severe cases swelling of skin, blisters, fever, headaches.	Ointments for mild cases if blisters appear and do not break. If breaking occurs, apply dry sterile dressing. Serious, extensive cases should be seen by a physician.
HEAT CRAMPS	Painful spasms usually in muscles of legs and abdomen possible. Heavy sweating.	Firm pressure on cramping muscles, or gentle massage to relieve spasm. Give sips of water. If nausea occurs, discontinue use.
HEAT EXHAUSTION	Heavy sweating, weakness, skin cold, pale, and clammy. Pulse thready. Normal temperature possible. Fainting and vomiting.	Get victim out of sun. Lay down and loosen clothing. Apply cool, wet cloths. Fan or move victim to air-conditioned room. Sips of water. If nausea occurs, discontinue use. If vomiting continues, seek immediate medical attention.
HEAT STROKE	High body temperature (106 degrees F or higher). Hot dry skin. Rapid and strong pulse. Possible unconsciousness.	Heat stroke is a severe medical emergency. Summon emergency medical assistance or get the victim to a hospital immediately. DELAY CAN BE FATAL. Move the victim to a cooler environment. Reduce body temperature with cold bath or sponging. Use extreme caution. Remove clothing, use fans and air conditioners. If temperature rises again, repeat process. Do not give fluids.

Source: Quad Cities Chapter of the American Society of Safety Engineers

FIGURE 3-2

WIND CHILL CHART
Effective Cooling on Exposed Skin

Calm	Wind Speed-mph						
	5	10	15	20	25	30	35
Temperature (Degrees F)	Wind Chill						
45	43	34	29	26	23	21	20
40	37	28	23	19	16	13	12
35	32	22	16	12	8	6	4
30	27	16	9	4	1	-2	-4
25	22	10	2	-3	-7	-10	-12
20	16	3	-5	-10	-15	-18	-20
15	11	-3	-11	-17	-22	-25	-27
10	6	-9	-18	-24	-29	-33	-35
5	0	-15	-25	-31	-36	-41	-43
0	-5	-22	-31	-39	-44	-49	-52
-5	-10	-27	-38	-46	-51	-59	-64
-10	-15	-34	-45	-51	-59	-64	-67
-15	-21	-40	-51	-60	-66	-71	-74
-20	-26	-46	-58	-67	-74	-79	-82
-25	-31	-52	-65	-74	-81	-86	-89

In using the table above, values of wind chill below -10° F are considered bitterly cold. Values of wind chill below -20° F are extremely cold -- human flesh will begin to freeze within one minute.

Source: <http://www.weatherpoint.com/weather/glossary/text/wchill.htm>

4.0 PERSONNEL TRAINING REQUIREMENTS

4.1 TRAINING

Personnel working in a Secure Zone will have forty (40) hours of documented training pursuant to OSHA 29 CFR 1910.120(e). In addition, each individual as appropriate, will have received in the past year, eight (8) hours of documented annual refresher training. Supervisory personnel will also have received at least eight (8) additional hours of supervisory training. Documentation of classroom training and alternative training experience will be made available upon request by the Brown and Caldwell Project Health and Safety Manager for contractors' personnel.

This site HASP will be made available prior to the start of subcontractors field activities. A pre-operation meeting will be held to discuss the contents of the Plan. Specialty training will be provided as needed based on task and responsibility. All site-specific contractor training will be conducted under direct supervision of the Contractor Health and Safety Manager or their designee and training documentation provided for the Brown and Caldwell files.

4.2 TRAINING AND BRIEFING TOPICS FOR SITE ACTIVITIES

Pre-entry briefings shall be held by the Site Safety Officer prior to initiating contractor site activity, at other times as necessary to ensure that employees are apprised of the LCP Superfund Site HASP, and that this Plan is being followed. Prior to beginning new site activities, all personnel will attend a task-specific Health and Safety orientation. The purposes of this orientation will be to familiarize project personnel with task-specific hazards, to ensure compliance with the HASP, and to fulfill Hazard Communication regulations. These topics will be discussed by the Site Safety Officer during the work start-up orientation:

- Description of chemical and physical hazards
- Medical surveillance and training requirements
- Levels of protection, including respiratory protection, if required

- Site control measures and work zones
- Health and safety chain-of-command
- Hospital directions, emergency procedures, and telephone numbers
- Reporting of injuries and illnesses
- Brown and Caldwell's task-specific activities previously found in "Tasks, Potential Hazards, and Control Measures" (Table 3-1).

Personnel performing sampling of or working around mercury will receive mercury awareness training, discussing the dangers of mercury and steps that can be taken to protect workers that will include:

- Possible routes of exposure to mercury
- The known health effects associated with exposure
- The importance of good personal hygiene
- The proper use and maintenance of protective clothing and equipment
- The correct use of engineering controls and implementation of good work practices

Personnel who will be working in the Exclusion Zone will attend the work start-up briefing and complete the previously noted "Acknowledgment" form (Attachment A) attesting to their review of the HASP and attendance at the work start-up briefing. Additional training may occur on a daily basis relative to planned tasks and may also occur as events or circumstances arise that require revision of the HASP.

Exemptions from training are subject to the review and approval of the Project Health and Safety Manager and will be noted in the site Health and Safety Logbook.

5.0 PERSONAL PROTECTIVE EQUIPMENT TO BE USED

This HASP establishes minimum health and safety requirements for potential mercury and other chemical exposures to personnel at Brown and Caldwell. The requirements are consistent with the rules and regulations established by the Occupational Safety and Health Administration (OSHA). The principal objective of the program is to minimize exposure of Brown and Caldwell employees to mercury.

5.1 PERSONAL PROTECTION

Use of personal protective equipment (PPE) is a major means to minimize potential exposure. The levels of protection for personnel have been based on OSHA Guidelines for the compounds of concern, the U.S. Environmental Protection Agency (EPA) Occupational Health and Safety Manual, and the Hazardous Substances Data Bank of the National Library of Medicine.

Personnel working in the Secure Zone will have their own personal safety equipment and protective clothing, which will be used according to the direction of the Site Safety Officer. Non-disposable PPE will be kept clean and maintained. Personnel will be trained in the use and maintenance of PPE and will be properly fitted prior to beginning site activities.

It is unlikely that personnel will encounter conditions which are immediately dangerous to life and health (IDLH). Therefore, no special engineering controls or extraordinary work practices are deemed necessary at this time.

5.2 LEVELS OF PERSONAL PROTECTION

The levels of personal protection expected to be used are summarized in Table 5-1. Modified Level D will be the minimum level of protection for personnel conducting activity within a Secure Zone; e.g., drilling activities. Modified Level D consists of:

- Hard hat
- Safety Glasses w/ splash protection
- Tyvek coveralls
- Latex gloves
- Safety Shoes w/ disposable boot covers
- Note: Latex gloves and disposable boot covers are generally required only in areas where a significant potential for mercury exposure exists. The Site Safety Officer will determine whether or not they are needed for a particular activity.

Level C defines the protection required when either or both of the following measurements are indicated:

- Mercury vapor readings above 0.025 mg/m³ in the breathing zone over a five-minute period.
- PID readings greater than 10 ppm above background in the breathing zone over a five-minute period.

Level C consists of Modified Level D plus air-purifying respirators with organic vapor/mercury vapor cartridges. The end of service life for this cartridge is indicated by a color-change indicator. No deviation from this level will be made without first contacting the Project Health and Safety Officer.

Work will cease under one or more of the following conditions:

- Mercury vapor readings in excess of 0.2 mg/m³ in the breathing zone for five (5) minutes.
- PID readings in the breathing zone above 100 ppm in the breathing zone for five (5) minutes.

Odor threshold values are listed in Table 3-2. These values will be reviewed by the Site Safety Officer to ensure that the odor threshold values of potential compounds are below the PEL standard as listed in Table 3-2. Unusual reports of odor should be investigated thoroughly. Exposure to compounds could occur if the odor threshold is higher than the PEL. If potential compounds have odor thresholds higher than the PELs, monitoring equipment must be relied upon to indicate airborne contaminants. Should monitoring equipment show ambient air levels above background, all personnel will evacuate until the Project Health and Safety Officer is contacted and provisions are made to enter the area with the use of respiratory protection.

5.3 CHEMICAL RESISTANCE/INTEGRITY OF PROTECTIVE MATERIAL

Generic clothing materials in Table 5-2 and in Table B-5 in Appendix B have been matched with various chemical classes that may be encountered during the performance of tasks covered under this HASP. Additional information regarding the integrity and limitations of personal protective equipment can be found in the publication *Quick Selection Guide to Chemical Protective Clothing* (1993). Should compounds be encountered on site that have not been identified by this HASP or are not printed within the Guide, the Project Health and Safety Manager must be contacted.

5.4 INSPECTION OF PROTECTIVE EQUIPMENT

The proper inspection of PPE features several sequences of inspection depending upon the specific articles of PPE and frequency of use. The different levels of inspection are as follows:

- Inspection and operational testing after receiving equipment from the factory, supplier, or distributor.
- Inspection of equipment when issued to workers.
- Inspection after use, training demonstrations, or following maintenance.

- Periodic inspection of stored equipment.
- Periodic inspection when a question arises concerning the appropriateness of the selected equipment, or when problems with similar equipment arises.

The primary inspection of PPE for activities will occur prior to immediate use and will be performed by the user so that the specific device or article has been checked out by the user, and the user is familiar with its use. Table 5-3 is a PPE Inspection Checklist that should be referenced before, during, and after use of personal protective equipment.

5.5 SPECIFIC LEVELS OF PROTECTION PLANNED FOR THE SITE

Modified Level D of protection will be utilized during activities at the site unless air monitoring indicates a higher level of PPE is required (see Table 5-1). Personal protective equipment will be stored in a clean, dry area until it is used.

TABLE 5-1

ACTION LEVELS FOR UPGRADING PERSONAL PROTECTIVE EQUIPMENT

Level	Level Application
MODIFIED LEVEL D	
<ul style="list-style-type: none"> • Work uniform with long pants • Tyvek® coveralls^a • Latex Gloves^b • Steel toe boots w/ disposable boot covers^b • Safety glasses with side shields • Hard hat and hearing protection as required • Breathing zone air monitoring with a PID (10.2 eV lamp) and a mercury vapor analyzer (MVA). 	<ul style="list-style-type: none"> • Breathing zone PID reading less than 10 ppm for more than five minutes. • Breathing zone MVA less than 0.025 mg/m³ for more than five minutes.
LEVEL C	
Modified Level D plus:	
<ul style="list-style-type: none"> • Tyvek® coveralls with hood • Full face respirators equipped with cartridges for organic gases and vapors^a or particulates • Breathing zone air monitoring with a PID (10.2 eV lamp) and a mercury vapor analyzer (MVA). 	<ul style="list-style-type: none"> • Breathing zone PID readings in excess of 10 ppm for more than five minutes. • Breathing zone MVA readings in excess of .025 mg/m³ over for more than five minutes.
<u>CEASE WORK!</u>	
	<ul style="list-style-type: none"> • Breathing zone PID readings in excess of 100 ppm for more than five minutes. • Breathing zone MVA readings in excess of 0.2 mg/m³ for more than five minutes.

Notes:

- a Tyvek® coveralls to be used during specified sampling or drilling operations. Cotton gloves and undergarments are recommended to be worn to provide for perspiration absorption which serves as a cooling device for the body.
- b Latex gloves and shoe covers are required only in areas where a significant potential for mercury exposure exists.

TABLE 5-2

**CHEMICAL PROTECTION OF CLOTHING MATERIALS
BY GENERIC CLASS**

Generic Class	Butyl Rubber	Polyvinyl Chloride	Neoprene	Natural Rubber
Alcohols	E	E	E	E
Aldehydes	E-G	G-F	E-G	E-F
Amines	E-F	G-F	E-G	G-F
Esters	G-F	P	G	F-P
Ethers	G-F	G	E-G	G-F
Fuels	F-P	G-P	E-G	F-P
Halogenated Hydrocarbons	G-P	G-P	G-F	F-P
Hydrocarbons	F-P	F	G-F	F-P
Inorganic Acids	G-F	E	E-G	F-P
Inorganic Bases and Salts	E	E	E	E
Ketones	E	P	G-F	E-F
Natural Fats and Oils	G-F	G	E-G	G-F
Organic Acids	E	E	E	E

Legend: E – Excellent
 G – Good
 F – Fair
 P – Poor

Source: Survey of Personnel Protective Clothing and Respiratory Apparata, September 1974, DOT, USCG, Office of Research and Development

TABLE 5-3
SAMPLE PPE INSPECTION CHECKLISTS

CLOTHING

Before Use:

- Determine that the clothing material is correct for the specified task at hand.
- Visually inspect for:
 - imperfect seams
 - non-uniform coatings
 - tears
 - malfunctioning closures
- Hold up to the light and check for pinholes.
- Flex product:
 - observe cracks
 - observe for other signs of shelf deterioration
- If the product has been used previously, inspect inside and out for signs of chemical attack:
 - discoloration
 - swelling
 - stiffness

During the work task, periodically inspect for:

- Evidence of chemical attack such as discoloration, swelling, stiffening, and softening. Keep in mind however, that chemical permeation can occur without any visible effects.
- Closure failure
- Tears
- Punctures
- Seam discontinuities

GLOVES

Before Use:

- Visually inspect for:
 - imperfect seams
 - tears, abrasions
 - non-uniform coating
- pressurize glove with air; listen for pin-hole leaks

BOOT COVERS

Before Use:

- Visually inspect for:
 - imperfect seams
 - tears
 - missing or ripped elastic band
 - insects, snakes, spiders, etc. that may have crawled into PPE

FULL-FACE RESPIRATOR INSPECTION

Before Use:

- Visually inspect for:
 - proper size
 - proper cartridges
 - cleanliness
 - exhalation valves
 - inhalation valves
 - facepiece cracks, splits
 - gasket for cartridge seal
 - deformities in facepiece
 - integrity of straps
 - Perform positive and negative pressure fit test every time respirator is worn
-

TABLE 5-4

GLOVE MATERIALS - COMPARATIVE CHEMICAL RESISTANCE

Chemical	Neo-prene	Natural Latex or Rubber	Milled Nitrile	Butyl	Chemical	Neo-prene	Natural Latex or Rubber	Milled Nitrile	Butyl
Acetaldehyde	E	G	G	E	Cyanide	G	G	G	G
Acetate	G	F	P	G	Cyclohexane	G	F	G	F
Acetic acid	E	E	E	E	Cyclohexanol	G	F	E	G
Acetone	G	E	P	E	Cyclohexanone	G	E	F	G
Acetylene gas	E	E	E	E	Decaborane	F	P	F	F
Acetylene tetrachloride	F	NR	F	F	Degreasing fluids	F	P	G	P
Acrylonitrile	G	F	F	G	Diacetone alcohol	E	E	E	E
Amidol	G	E	F	E	Diborane	F	P	F	F
Amine hardeners	F	F	G	G	Dibenzyl ether	G	G	F	G
Ammonium hydroxide	E	E	E	E	Dibutyle phthalate	G	P	G	G
Amyl acetate	F	P	P	F	Dichloroethane	P	NR	F	NR
Amyl alcohol	E	E	E	E	Dichloropropene	P	P	F	F
Anhydrous ammonia	G	E	E	E	Diesel fuel	G	P	E	P
Aniline	G	F	P	F	Diethanolamine	E	G	E	E
Aniline hydrochloride	F	G	P	F	Diethylamine	E	G	E	G
Aniline oil	F	G	P	F	Diethyltriamine	G	F	E	G
Animal fats	E	P	E	G	Diisobutyl ketone	P	F	P	G
Animal oils	E	F	E	G	Diisocyanate	G	P	G	E
Anodex	G	E	--	E	Dimethyl formamide	F	F	G	G
Anthracene	F	P	F	P	Diocetyl phthalate	G	P	E	F
Aromatic fuels	P	NR	F	NR	Dioxane	E	G	G	G
Arsine	E	E	E	E	Emulsifying agent	G	F	E	E
Asbestos	E	E	E	E	Emulthogene	G	F	G	E
Asphalt	G	F	E	F	Epichlorohydrin	G	P	F	G
Banana oil	F	P	P	F	Epoxy resins, dry	E	E	E	E
Benzaldehyde	F	F	G	G	Esters	F	P	P	F
Benzene	P	NR	F	NR	Ethane gas	E	G	E	E
Benzol	P	NR	F	NR	Ethanol	E	E	E	E
Benzyl alcohol	E	E	E	E	Ethers	E	G	G	G
Benzyl benzoate	G	F	G	F	Ethyl acetate	G	F	F	G
Benzyl chloride	F	P	F	G	Ethyl alcohol	E	E	E	E
Biacosolve	G	P	G	P	Ethyl bromide	--	--	P	--
Boron tribromide	G	P	P	P	Ethyl ether	E	G	G	E
Bromine	G	P	P	P	Ethyl cutyl ketone	--	--	P	--
Bromoform	G	P	P	P	Ethyl formate	G	F	G	G
Butane	E	F	E	F	Ethylaniline	F	F	P	G
2-Butanone	G	G	F	G	Ethylenediamine	E	G	E	G
Butyl acetate	G	F	P	F	Ethylene dichloride	F	P	P	F
Butyl alcohol	E	E	E	E	Ethylene gas	E	G	E	E
Butylaldehyde	G	G	E	G	Ethylene glycol	E	E	E	E
Butylene	E	G	E	G	Ethylene oxide	G	F	G	--
Cadmium oxide fume	E	E	E	E	Ethylene trichloride	F	P	G	P
Calcium hydroxide	E	E	E	E	Fatty acids	E	P	E	F
Carbolic acid	E	E	F	E	Ferrocyanide	F	G	G	E
Carbon dioxide	E	E	E	E	Fluoric acid	E	G	E	E
Carbon disulfide	F	F	F	F	Fluorine	G	F	F	G
Carbon tetrachloride	F	P	G	P	Flourine gas	G	F	F	G
Castor oil	F	P	E	F	Formaldehyde	E	E	E	E
Cellosolve	F	G	G	G	Formic acid	E	E	E	E
Cellosolve acetate	G	F	G	G	Freon 11	G	P	G	F
Chlordane	G	F	G	F	Freon 12	G	P	G	F
Chlorine	G	F	F	G	Freon 21	G	P	G	F
Chlorine gas	G	F	F	G	Freon 22	G	P	G	F
Chlorobenzene	F	P	P	F	Furfural	G	G	G	G
Chloroacetone	F	F	P	E	Gasoline, leaded	G	P	E	F
Chlorobromomethane	F	P	F	P	Gasoline, unleaded	G	P	E	F
Chloroform	G	P	E	P	Glycerine	E	E	E	E
Chloronaphthalene	F	P	F	F	Glycerol	E	E	E	E
Chlorophenylene diamine	G	P	F	F	Glycol	E	E	E	E
Chloropicrin	P	P	P	F	Gold fluoride	G	E	E	E
Chloroethene	P	NR	F	NR	Grain alcohol	E	E	E	E
Chromic acid	F	P	F	F	Halogens	G	F	F	G
Chromotex	G	G	G	G	Hexamethylenetetramine	F	G	F	G
Citric acid	E	E	E	E	Hexane	F	P	G	P
Cool tar pitch volatiles	F	P	F	--	Hexyl acetate	F	P	P	F
Cottonseed oil	G	G	E	E	Hydraulic oil	--	--	--	--
Cotton dust (raw)	E	E	E	E	ester base	E	P	F	G
Creosote	G	G	F	G	petroleum base	G	P	E	P
Cresol	G	G	F	G	Hydrazine	F	G	G	G
Cupric nitrate	G	G	E	E	Hydrochloric acid	E	G	G	G
					Hydrofluoric acid	E	G	G	G

(KEY: E - excellent; G - good; F - fair; P - poor; NR - not recommended)

TABLE 5-4 (Continued)

GLOVE MATERIALS - COMPARATIVE CHEMICAL RESISTANCE

Chemical	Neo- prene	Natural Latex or Rubber	Milled Nitrile	Butyl	Chemical	Neo- prene	Natural Latex or Rubber	Milled Nitrile	Butyl
Hydrogen gas	E	E	E	E	Phenylenediamine	G	P	G	G
Hydrogen peroxide 30%	G	G	G	G	Phenylhydrazine	G	G	G	G
Hydrofluosilicic acid	F	G	G	G	Phil. solv	E	F	E	G
Hydroquinone	G	G	F	G	Phosphoric acid	E	G	E	E
Inorganic salts	E	E	E	E	Pickling solution	G	G	G	E
Iodine	G	F	G	G	Picric acid	E	G	E	G
Isooctane	F	P	E	P	Pine oil	E	P	E	F
Isopropanol	E	E	E	E	Pitch	E	P	E	F
Isopropyl alcohol	E	E	E	E	Plating solutions	E	E	E	E
Kerosene	E	F	E	F	Potassium alum	G	G	G	E
Ketones	G	E	P	E	Potassium bromide	G	G	G	E
Lacquer thinner	G	F	P	F	Potassium chrome alum	G	G	G	E
Lactic acid	E	E	E	E	Potassium dichromate	F	F	F	E
Lauric acid	E	F	E	E	Potassium ferrocyanide	G	G	G	E
Linoleic acid	E	P	E	F	Potassium hydroxide	E	E	E	E
Linseed oil	E	P	E	F	Printing inks	E	G	G	G
Maleic acid	E	E	E	E	Propane gas	E	E	E	E
Mercuric chloride	G	E	G	E	Propanol (iso)	E	E	E	E
Mercury	G	G	G	E	Propyl acetate	G	F	F	G
Methane gas	E	E	E	E	Propyl alcohol	E	E	E	E
Methanol	E	E	E	E	Propyl alcohol (iso)	E	E	E	E
Methyl acetate	G	F	P	G	Propylene gas	E	F	E	E
Methyl alcohol	E	E	E	E	Propyne gas	E	F	E	E
Methylamine	F	F	G	G	Pyrethrum	E	E	E	E
Methyl bromide	G	F	F	G	Red fuming nitric acid	P	P	P	P
Methyl cellosolve	G	G	G	G	Rhodium fume and dust	E	E	E	E
Methyl chloride	NR	NR	NR	NR	Silver nitrate	E	G	E	E
Methyl ethyl ketone	G	G	NR	E	Skydrol 500	P	G	P	G
Methyl formate	G	F	F	G	Sodium carbonate metal	G	G	G	E
Methylene bromide	G	G	F	G	Sodium hydroxide	E	E	E	E
Methylene chloride	G	F	F	G	Sodium sulfite	G	G	E	E
Methyl isobutyl ketone	F	F	P	E	Sodium thiosulfide	G	G	E	E
Methyl methacrylate	G	G	F	E	Solvarsol	E	F	E	F
Mineral oils	E	F	E	F	Solvessos	P	P	G	P
Monochlorobenzene	F	P	P	F	Stearic acid	E	E	E	E
Monoethanolamine	E	G	E	E	Stoddard solvent	E	F	E	G
Morpholine	E	E	G	E	Styrene	P	P	F	P
Muriatic acid	E	G	G	E	Styrene 100%	P	P	F	P
Naphthalene	G	F	G	F	Sulfuric acid	G	G	G	G
Naphthas, aliphatic	E	F	E	F	Tannic acid	E	E	E	E
Naphthas, aromatic	G	P	G	P	Tetrahydroborane	F	P	F	F
Nitric acid	G	F	F	F	Tetraethyl lead	E	F	E	G
Nitric acid, red and white fuming	P	P	P	P	Tetrahydrofuran	P	F	F	F
Nitrobenzene	F	P	F	F	Toluene	F	P	F	NR
Nitroethane	F	P	F	F	Toluene diisocyanate	F	G	F	G
Nitrogen gas	E	E	E	E	Toluol	F	P	F	NR
Nitromethane	F	P	F	F	Trichlor	F	P	G	P
Nitropropane	F	P	F	F	Trichloroethane	F	F	G	P
Nitrous oxide	G	G	G	G	Trichloroethylene	P	P	F	P
Octyl alcohol	E	E	E	E	Tricresyl phosphate	G	F	E	F
Oleic acid	E	F	E	G	Tridecyl alcohol	G	F	E	F
Oxalic acid	E	E	E	E	Triethanolamine	E	G	E	G
Oxygen, liquid	F	P	NR	F	Trinitrotoluene	G	P	G	F
Ozone	G	P	P	G	Trinitralolual	G	P	G	F
Paint thinners	G	F	G	F	Triplane	E	P	E	F
Paint and varnish removers	G	F	F	F	Tung oil	E	P	E	F
Palmitic acid	E	E	E	E	Turca No. 2998	P	P	-	F
Paradichlorobenzene	E	F	E	E	Turpentine	G	F	E	F
Parathion	P	F	F	F	Unsymmetrical Dimethylhydrazine	-	-	-	-
Pentaborane	F	P	F	F	Varnoline gas	E	F	E	F
Pentachlorophenol	F	G	G	G	Vanadium fume and dust	E	E	E	E
Pentane	E	G	E	G	Varsol	G	F	G	F
Perchloric acid	E	F	G	G	Vegetable oils	E	G	E	G
Perchloroethylene	F	NR	G	NR	Wood alcohol	E	E	E	E
Perkiene	E	NR	G	NR	Wood preservatives	G	F	G	G
Permachlor	E	F	E	NR	Woodyouth	F	P	F	G
Petroleum distillates (naphtha)	-	-	-	-	Xylene	P	P	F	P
Petroleum spirits	E	F	E	F	Xylol	P	P	F	P
Phenol	E	F	F	G	Xylidene	E	F	F	F
					Zinc chloride	E	E	E	E

(KEY: E - excellent; G - good; F - fair; P - poor; NR - not recommended)

6.0 MEDICAL SURVEILLANCE REQUIREMENTS

6.1 GENERAL OSHA REQUIREMENTS

OSHA has established requirements for a medical surveillance program designed to monitor and reduce health risks for employees potentially exposed to hazardous wastes covered under the Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard 29 CFR 1910.120(f). Employees are required by federal regulations to have medical monitoring if they are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits, without regard to the use of respirators, for 30 days or more a year.

This program has been designed to provide baseline medical data for each employee involved in hazardous waste operations and to determine his/her ability to wear personal protective equipment, such as chemical resistant clothing and respirators. Employees who wear or may wear respiratory protection must be provided respirators as regulated by 29 CFR 1910.134. This Standard requires that an individual's ability to wear respiratory protection be medically certified before he/she performs designated duties. Where medical requirements of 29 CFR 1910.120(f) overlap those of 29 CFR 1910.134, the more stringent of the two will be enforced.

The medical examinations will be administered on a pre-employment and annual or biannual basis, as warranted in opinion of examining doctor by symptoms of exposure or specialized activities. These examinations will also be provided to employees upon termination of employment or reassignment to non-hazardous waste site activities. These examinations shall be provided by employers without cost or loss of pay to the employee. For the purposes of this HASP, contractors shall assume the employer's responsibility in obtaining the necessary medical monitoring for their employees and provide compliance documentation upon request.

6.2 MEDICAL EXAMINATIONS

Periodic medical examinations will be provided to Brown and Caldwell personnel covered under the HAZWOPER standard and will be conducted within the past 12 months by a licensed physician. This time period may be lengthened or shortened under the recommendations of the physician. The physician will keep permanent records of examinations and maintain this documentation in a central file which will be available upon request from authorized personnel.

Medical monitoring should meet or exceed regulatory compliance issues pursuant to OSHA 29 CFR 1910.94, .120, .134 and .1001 through .1050. Included within these regulatory issues are the determination by a physician that an individual being examined is physically able to use an air-purifying respirator and is able to perform the work within the specific job description. The capability of an individual to perform the specified work will be determined from examinations that will include:

- Detailed medical and work histories
- Physical examination with special attention to target organ systems
- Pulmonary function test (FVC and FEV1)
- Chest x-ray every three years (earlier if required by a physician)
- ECG (Electrocardiogram)
- Eye examination and visual acuity screening
- Audiometry
- Urinalysis
- Blood chemistry (hematology, serum analyses, heavy metals toxicology).

When necessary, additional testing may be performed at the discretion of the examining physician to determine fitness for duty, to comply with other OSHA standards, or other mandated requirements. The physician should discuss findings of the exam and test results with the employee, including non-occupational issues related to personal lifestyle or dietary choices.

6.3 EXPOSURE/INJURY/MEDICAL SUPPORT

Personnel covered by this HASP must report injuries and exposures and are encouraged to seek medical attention and physical testing following an injury or possible exposure above established exposure levels.

7.0 FREQUENCY AND TYPES OF AIR MONITORING

The purpose of air monitoring is to identify and quantify airborne contaminants in order to verify and determine the level of personal protection required. Initial screening for identification is generally qualitative. Subsequent testing is typically required to quantify concentrations. Continuous air monitoring will be used in secure areas to identify airborne contaminants using direct reading instruments, including:

- Jerome 431-X mercury vapor analyzer (MVA).
- Photoionization detector (PID) (HNU Model PI-101 or equivalent equipped with a 10.2 eV lamp).

Continuous air monitoring will be conducted at each Secure Zone using the PID and MVA. Background PID and MVA readings will be obtained once each morning after calibration and following lunch. The background reading will be taken in an area removed and upwind of the site. The action levels for the PID and MVA as measured in the breathing zone, contained in Table 5-1 are as follows:

- Modified Level D
 - MVA $< 0.025 \text{ mg/m}^3$
 - PID $< 10 \text{ ppm}$ above background
- Modified Level C - with respirator and organic/mercury vapor and particulate cartridges
 - MVA $> 0.025 \text{ mg/m}^3$
 - PID $> 10 \text{ ppm}$ above background -.
- Cease work
 - MVA $> 0.2 \text{ mg/m}^3$
 - PID $> 100 \text{ ppm}$

Specification sheets for the monitoring equipment will be maintained within their shipping or storage containers. Included will be methods for calibration, operation, troubleshooting, and minor repair. Availability of the specification sheets will be monitored by the Site Safety Officer. Deficiencies or operating problems with monitoring equipment will be made known to the Project Health and Safety Officer. The continuous monitoring equipment will be serviced and batteries placed on charge, as they are required. A maintenance log will be maintained for monitoring equipment and major discrepancy or operating malfunction must be brought to the attention of the Project Health and Safety Officer within 24 hours.

8.0 SITE CONTROL MEASURES

8.1 GENERAL

Standard work practices and engineering controls can be used to control hazards. For instance, particulate dust can be suppressed by utilizing water sprays or covering materials such as burlap. When the control procedures prove to be inadequate to ensure worker safety, appropriate personal protective equipment must be worn if exposures exceed the permissible exposure limits.

Activities that can potentially bring workers in contact with organic vapors will be monitored with either a photoionization detector (PID) or other direct reading instruments capable of responding to compounds or substances listed in Table 3-1. Activities in areas known to contain dust hazards should be monitored for airborne particulate levels.

Best Management Practices (BMP) establish a safe and reasonable site speed limit of 5 miles per hour and require that personal vehicles remain on the paved site surfaces.

8.2 SITE SECURITY AND SITE ACCESS

Site Security is provided by chain-link fencing around the perimeter of the site. Access is limited by locked gates. Site personnel are to notify the local police in the event that an unauthorized person is observed on the site.

Access into Secure Zones will be established at a 50-foot radius and indicated by one or more visible surface devices such as cones, tape, barriers, and/or fencing. The Site Safety Officer will check the integrity of the secured areas throughout the workday. Planned activities requiring personnel access to a Secure Zone will be coordinated between ISP-ESI and the Brown and Caldwell Site Safety Officer. Should access control be required during the nighttime hours, the Site Safety Officer, through ISP-ESI, will arrange for security. Personnel entering the work zone are required to acknowledge reading the HASP previously noted as Attachment A, and to adhere to the Plan requirements while in the vicinity.

Visitors to the site must provide their own National Institute of Occupational Safety and Health (NIOSH) approved safety equipment meeting the requirements of this HASP or they will be denied entry and access to the work site.

8.3 SITE COMMUNICATION

Successful communications between field teams and contact with personnel in the Support Zone is essential. The following communication systems will be available within Secure Zones:

- Normal verbal communication, which can include 2-way radios
- Hand signals for Level B and C are as follows:

<u>Signal</u>	<u>Definition</u>
Hands clutching throat	Out of air / cannot breath
Hands on top of head	Need assistance
Thumbs up	OK / I am all right / I understand
Thumbs down	No / Negative
Arms waving upright	Send backup support
Grip partners wrist	Exit area immediately

Brown and Caldwell personnel typically have access to a mobile cellular telephone that is present on site or carried in their vehicle.

8.4 DECONTAMINATION PROCEDURES

Decontamination is the physical process of removal of contaminants or potential contaminants from personnel and equipment before leaving the site. At this site, decontamination will primarily consist of the collection of materials into containers at decontamination stations established within Secure Zones designated by the Site Safety

Officer. Those items for disposal will be collected in a plastic-lined container and disposed of in a proper manner established by ISP-ESI Material Safety Data Sheets will be kept on site for chemicals used in the decontamination process.

Personnel involved in decontamination operations will be required to wear a splash-resistant coverall or apron, safety glasses, and rubber gloves for this task. Personnel decontamination will primarily consist of the removal of outer protective clothing and placement into containers. Following removal of outer protective clothing, personnel will be encouraged to shower as soon as possible and change into clean clothing.

The health and safety staff will be notified in the event that non-disposable equipment becomes contaminated with mercury.

8.5 LEVELS OF DECONTAMINATION REQUIRED FOR PERSONNEL

Modified Level (D) PPE will typically be worn during site activities. Higher levels of protective clothing could be required depending on the results of air monitoring. A decontamination area will be established in each Secure Zone for both personnel and equipment. The Modified Level D decontamination procedure will be:

- Step 1 - Removal of outer boots.
- Step 2 - Removal of outer gloves.(If Applicable)
- Step 3 - Removal of Tyvek clothing.
- Step 4 - Removal of inner gloves.

Note: The use of outer gloves is not required under this HASP.

Should immediate medical attention be required to save a life, decontamination shall be delayed until the victim is stabilized. However, if decontamination can be performed without interfering with first aid or life saving techniques, or should a worker be contaminated with an extremely toxic or corrosive material that has the potential to cause severe injury or loss of life, decontamination must be performed immediately. If an

emergency due to heat-related illness develops, protective clothing shall be removed from the individual to reduce heat stress. During an emergency, provisions shall also be made for protecting medical personnel and disposing of contaminated clothing and equipment. Additional detailed decontamination information is contained in Appendix B.

9.0 EMERGENCY/DISASTER CONTINGENCY PLAN

9.1 PRE-EMERGENCY PLANNING

This section will be reviewed with project personnel along with the HASP before the project start-up in order to identify the potentially hazardous conditions that may be associated with specific task activities. The Emergency/Disaster Contingency Plan will be reviewed and revised as necessary by the Site Safety Officer.

9.2 PERSONNEL ROLES AND LINES OF AUTHORITY

The Site Safety Officer has the primary responsibility for coordinating response to emergencies on the project site. It is the responsibility of anyone observing an emergency situation to notify the Site Safety Officer. In case the Site Safety Officer cannot be reached immediately, the person observing the emergency can contact the appropriate emergency service (Table 9-1).

The SSO is responsible for reviewing the work to be performed on known or suspected mercury materials and evaluating the potential for mercury disturbance in compliance with the HASP. The SSO has the authority to audit compliance with the provisions of this procedure, suspend work or modify work practices for safety reasons, and to dismiss from work areas individual whose conduct endangers the health and safety of others.

9.3 MEDICAL ASSISTANCE/EMERGENCY CONTACTS

In the event of personnel exposure, accident, injury, or fire at the LCP Superfund Site facility, the following general accident and emergency response procedures are to be followed by personnel working under this HASP. The Site Safety Officer should notify the Project Director and the Project Health and Safety Manager as soon as possible, and explain that an emergency incident has or is occurring. Individuals should contact the appropriate persons noted in Table 9-1.

Activities that may require outside responsive actions to mitigate an emergency situation shall be handled by the Site Safety Officer.

9.4 MEDICAL EMERGENCY RESPONSE

The closest medical emergency center to the LCP Superfund Site is as follows:

**Rahway Hospital
865 Stone Street
Rahway, New Jersey 07065-2797
732-381-4200**

The directions to Rahway Hospital are shown on Figure 9-1 and are listed as follows:

- Turn right out of site onto TREMLEY POINT RD (over the turnpike) towards SOUTH WOOD AVE - 0.8 miles
- Turn LEFT onto MAIN ST. - 0.2 miles
- Turn SLIGHT RIGHT onto PARKWAY AVE. - 0.2 miles
- Turn LEFT onto LOWER RD. - 1.3 miles
- LOWER RD becomes BARNETT ST. - 0.3 miles
- Stay straight to go onto E GRAND AVE. - 1.5 miles
- Turn LEFT onto ST GEORGES AVE/NJ-27. - 0.3 miles
- (Turn RIGHT onto MOSES DR. - 0.2 miles
- Turn LEFT onto JEFFERSON AVE. - 0.0 miles
- Turn RIGHT. - 0.1 miles

Total estimated time to hospital: 14 minutes

Total distance: 4.8 miles

Brown and Caldwell personnel may contact Dr. Elayne Theriault of Environmental Medicine Resources (EMR) with medical questions about occupational exposures at 1-800-229-3674 (7 days a week/24 hours a day), if necessary.

9.5 EMERGENCY RECOGNITION AND PREVENTION

Section 3.0 provided a listing of chemical and physical hazards that may be encountered. Typical hazards as a direct result of site activities are listed in Table 9-2 with suggested prevention and control techniques/mechanisms noted. Personnel working in Secure Zones will be familiar with the techniques of hazard recognition from preassignment training and from site-specific briefings. The Site Safety Officer is responsible for making preventive devices and equipment available to Secure Zone personnel.

9.6 EVACUATION ROUTES AND PROCEDURES

9.6.1 Work Area Evacuation

Should an emergency requiring evacuation occur, personnel will evacuate the area to a location pre-established by the Site Safety Officer. These locations will be selected, marked and will be at least 250 feet upwind of the Secure Zone. Following the evacuation, the Site Safety Officer will initiate a head count to check that personnel who entered the Secure Zone have successfully been evacuated.

In the event of an emergency which necessitates an evacuation of the Secure Zone, the following alarm procedure will be implemented:

- Three loud horn blasts - personnel will be expected to proceed to the designated evacuation area and will remain in the area until a re-entry to the Secure Zone is authorized.

9.6.2 Facility Evacuation

Evacuation of the facility may be required in the event severe weather including flooding, hurricane, electrical storms, or neighboring plant evacuation requirements. In the event that the normal route from the plant out to and including South Wood Avenue is inaccessible,

the LIMAC route will be used. The LIMAC route allows for evacuation of personnel from the area along the marked route through the various plants in the tremley point area. ISP-ESI personnel will notify LCP site workers if site evacuation is necessary due to surrounding site conditions and can assist workers at LCP if evacuation is needed due to conditions at LCP.

9.7 INCIDENT REPORTING

Following an accident or incident, an incident report will be completed by a responsible individual at the scene (refer to Incident/Accident Report, Figure 9-2). Information in the incident report will include the following items:

- Name(s) of individuals involved or witnesses
- Date and time
- Exact location
- Description of incident
- Type of exposure suspected or nature of injury
- Nature of emergency response actions
- Corrective measures taken to prevent repeat of the incident

Incident reports will be filed with the ISP-ESI Project Manager and Brown and Caldwell's Project Health and Safety Manager as soon as practical and a written report filed within 24 hours of the incident.

Further, in the event of a hazardous material spill or chemical release above the reportable quantity, the appropriate Federal and State agencies will be notified. Notification will be made from the Site Safety Officer to the ISP-ESI Project Manager who in turn shall report the incident to the appropriate regulatory agency.

9.8 EMERGENCY MEDICAL TREATMENT PROCEDURES

At least one individual present on the site must have current First Aid and Cardio-Pulmonary Resuscitation (CPR) training. Personnel with minor injuries can be treated on site. In the event of a serious injury, the person will be stabilized and the Linden Fire Department will be called on to transport them. All accidents must be reported to the Project Health and Safety Manager.

An individual who becomes ill or is injured while working within the Exclusion Zone must be decontaminated to the maximum extent possible. Should the injury or illness be minor in nature, a full decontamination of personnel will be administered prior to transport to a medical facility. If the individual's condition is serious, a quick decontamination of the person should be completed (i.e., complete clothing removal and redressing in clean overalls or wrap the individual in a blanket). First aid should be administered while awaiting an ambulance or trained medical personnel. Injuries and illnesses will be reported immediately as described in Section 9.2. A vehicle used to transport contaminated or potentially contaminated personnel will be decontaminated as necessary.

Should an accident occur where an employee rendering first aid is exposed to blood, contact the Project Health and Safety Manager immediately to report the incident, as required under the OSHA Bloodborne Pathogens Standard (29 CFR 1910.1030).

9.9 FIRE OR EXPLOSION

In the event of a fire or explosion, the Linden Fire Department should be notified immediately by calling (9-1-1). In addition the Project Health and Safety Manager and LCP Superfund Site Project Contact should be notified immediately.

9.10 SPILLS AND LEAKS

Personnel will report spills or leaks to the Site Safety Officer and the ISP-ESI Site Contact. Should a spill or leak occur which is a threat to human health or a release to environment (air, water or soil), the person observing the spill will:

- Evacuate or request an evacuation of persons at risk.
- Inform ISP-ESI Site Contact supervisor and/or Site Safety Officer immediately.
- Locate the source of the spillage and stop the flow if it can be done safely.
- If safe to do so, begin containment and recovery of the spilled materials utilizing appropriate response methodology and PPE.

9.11 EMERGENCY EQUIPMENT AND FACILITIES

The following equipment will be available on this site:

- First aid kit
- Fire extinguisher
- Portable eye wash
- Emergency water supply (10 gallon minimum) for emergency drenching

TABLE 9-1

EMERGENCY CONTACT PHONE LIST
LCP Chemicals Inc. Superfund Site, Linden, NJ

KEEP AVAILABLE AT ALL TIMES

LCP Inc. Superfund Site,
Foot of S. Wood Avenue
Linden, NJ, 07036-3124

ISP-ESI

Site Manager – Vince Quilban

908-747-5101

Project Manager – Scott MacMillin

201-818-6056 ext. 211

EMERGENCY SERVICES

Rahway Hospital

732-381-4200

Linden Police Department

908-474-8500

Linden Fire Department

911 or 908-298-3800

Union County Police Department

911 or 908-654-9800

Emergency Disaster Control

732-356-0087

Poison Control Center

800-962-1253

Regional USEPA Emergency Response

800-425-8500

National Response Center

800-424-8802

Brown and Caldwell Personnel

Office Number: 201-818-6055

Mahwah, New Jersey

Office Fax: 201-818-6057

Principal in Charge

Bob Mutch

Work Ext.: 226

Home: 201-327-2057

Project Manager

Scott MacMillin

Work Ext.: 211

Home: 845-496-5183

Site Safety Officer Jennifer Potter

Work Ext.: 280

Home:

Alt. Site Safety Officer Steve Hinton

Work Ext.: 238

Home:

Project H&S Manager Cynthia Doughty

Work Ext.: 201

Home: 845-343-2815

Environmental Medicine Resources
(EMR)

Dr. Elayne Theriault

800-229-3674

TABLE 9-2

EMERGENCY RECOGNITION AND CONTROL MEASURES

Hazard	Specific Condition Location	Prevention Control
Fire/Explosion	Borehole; wellhead; gasoline fueled equipment	Fire/safety inspections; Alarm system; Fire extinguisher; Evacuation routes
Air Release	Wellhead; seal opening with on site material	Water spray; foam; Alarm system; Evacuation routes
Spill	Drill cuttings; groundwater; DECON solvents and contaminated water/residues; well head; DECON station; staging area	Berms and dikes; Sorbent materials; Alarm system; Evacuation routes

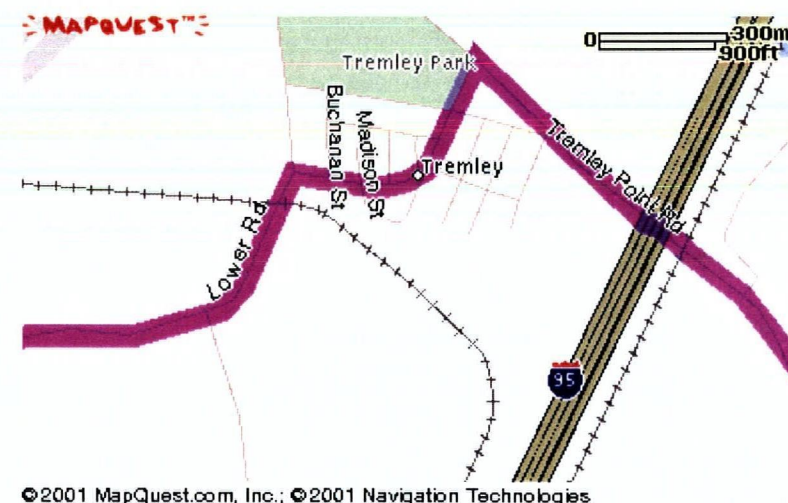
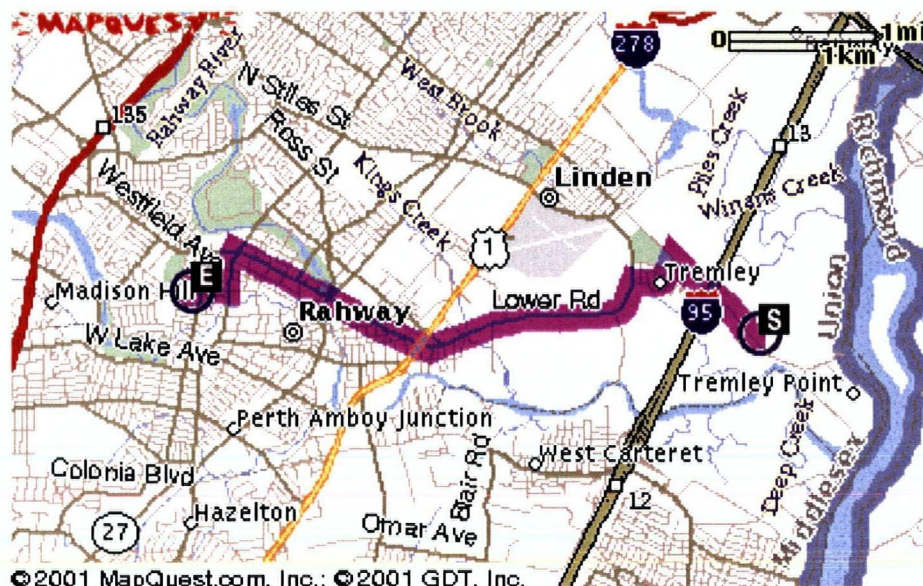


FIGURE 9-1

ROUTE TO HOSPITAL

LCP CHEMICALS INC. SUPERFUND SITE
LINDEN, NEW JERSEY

BROWN AND CALDWELL

**BROWN AND
CALDWELL**

**Attachment A—Health and Safety Plan
Employee Acknowledgment**

Employee Name

Project Name

Project Location

Project Number

LCP Chemicals, Inc. Superfund Site

Linden, NJ

21405

Employee Statement of Acknowledgment

I hereby certify that I have read and that I understand the safety and health guidelines contained in Brown and Caldwell's Health and Safety Plan for the above-named project.

Employee Signature

Date

In the Case of an Emergency, contact:

Name

Relationship

Phone Number

1. _____

2. _____

Name of Site Safety Officer Receiving This Form

Signature of Site Safety Officer

Date

NOTE: Send completed form to Health and Safety Director.

HS—16 REV. 06/98

**BROWN AND
CALDWELL**

**Attachment—B Health and Safety Plan
Site Activity and Safety Briefing**

Name of Site Safety Officer
Jennifer Potter

Signature of Site Safety Officer

Project Name
LCP Chemicals, Inc. Superfund Site

Project Location
Linden, NJ

Project Number
21405

Who attended the briefing?

Names of Brown and Caldwell Employees

Names of Subcontractor(s) Employees

What items were discussed?

- | | |
|--|--|
| <input type="checkbox"/> Health and Safety Plan | <input type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident | <input type="checkbox"/> Changes/Solutions to Specific Accident(s) |
| <input type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number |
| <input type="checkbox"/> Emergency Hospital Route | <input type="checkbox"/> Work Schedule |
| <input type="checkbox"/> Other _____ | |

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☐ NO

NOTE: Place a copy of the completed form in the project file.

HS—17 REV. 06/98

**BROWN AND
CALDWELL**

Attachment C—Health and Safety Plan Safety Plan Implementation Checklist

Project Name LCP Chemicals Inc. Superfund Site		Project Location (city and state) Linden, NJ	Date
Name of Site Safety Coordinator Jennifer Potter		Weather Conditions	Project Number 21405
BC Staff Present	Name	Office	
	_____	_____	
	_____	_____	
	_____	_____	
	_____	_____	

Indicate the status of each of the following:

- | | | | |
|--|------------------------------|-----------------------------|------------------------------|
| 1. Is a copy of the Health and Safety Plan (HASP) on site? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 2. Is the personal protective equipment required by the HASP available and being used correctly? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 3. Have the work zones been delineated? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 4. Has a decontamination station been set up as required by the HASP? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 5. Are the decontamination procedures being followed? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 6. Is access to the exclusion zone being controlled? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 7. Has the site activities briefing and tailgate safety meeting been provided? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 8. Is the list of emergency telephone numbers posted at the support zone? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 9. Are directions to nearest emergency medical assistance posted at support zone? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 10. Is emergency equipment available and functional, as required by the HASP? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 11. Has the nearest toilet facility been identified or a portable facility been set up? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 12. Has an adequate supply of drinking water been provided? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 13. Has water for decontamination been provided? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 14. Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the HASP? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 15. Are the instruments being used properly and periodically checked during the shift for battery charge status? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 16. Have the trenches and excavations been clearly marked? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 17. Have trenches and excavations been shored or sloped as required by soil type and work activities? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 18. Are dust suppression measures being used? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 19. Is food and tobacco consumption being restricted to the support zone? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 20. Has a confined space been identified as part of this project? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 21. Are the confined space entry procedures being correctly implemented? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 22. Has the work/rest cycle for the shift been established? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| TIME ON (minutes): _____ TIME OFF (minutes): _____ | | | |
| 23. Has a shaded rest area been set up in the support zone? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |

NOTE: Place completed form in project file.

HS—18 REV. 06/98

**BROWN AND
CALDWELL**

**Attachment D—Health and Safety Plan
Notice of Unsafe Conditions**

Contractor

Date

Project Name

LCP Chemicals, Inc. Superfund Site

Project Number

21405

THIS NOTICE . . .

This notice is to advise you, the Prime Contractor on the above-named Contract, that this Representative of the Owner of the above-mentioned Project has observed (on the date shown above) an unsafe condition on the Project.

These conditions are listed as follows:

ITEM

CONDITION

By this Notice, the Owner or its Representatives shall not assume any responsibility under the GENERAL CONDITIONS or assume any liability for the existence or correction thereof, for the unsafe conditions, or any others that may have been unnoticed.

These conditions shall be remedied as soon as possible within a safe working period. If these corrections are not made, the Owner will be forced to remove all field staff from the job. No payment shall be made for any work installed after this date without first examination of work in accordance with the GENERAL CONDITIONS.

Signature of Owner's Representative

Title

Date

Received by (Signature of Contractor's Representative)

Title

Date

NOTE: Place a copy of completed form in project file.

HS—19 REV. 06/98

**BROWN AND
CALDWELL**

**Attachment A—Health and Safety Plan
Employee Acknowledgment**

Employee Name

Project Name

Project Location

Project Number

LCP Chemicals, Inc. Superfund Site

Linden, NJ

21405

Employee Statement of Acknowledgment

I hereby certify that I have read and that I understand the safety and health guidelines contained in Brown and Caldwell's Health and Safety Plan for the above-named project.

Employee Signature

Date

In the Case of an Emergency, contact:

Name

Relationship

Phone Number

1. _____

2. _____

Name of Site Safety Officer Receiving This Form

Signature of Site Safety Officer

Date

NOTE: Send completed form to Health and Safety Director.

HS—16 REV. 06/98

**BROWN AND
CALDWELL**

**Attachment—B Health and Safety Plan
Site Activity and Safety Briefing**

Name of Site Safety Officer
Jennifer Potter

Signature of Site Safety Officer

Project Name
LCP Chemicals, Inc. Superfund Site

Project Location
Linden, NJ

Project Number
21405

Who attended the briefing?

Names of Brown and Caldwell Employees

Names of Subcontractor(s) Employees

What items were discussed?

- | | |
|--|--|
| <input type="checkbox"/> Health and Safety Plan | <input type="checkbox"/> Hazardous Site Conditions/Activities |
| <input type="checkbox"/> Specific Accident/Incident | <input type="checkbox"/> Changes/Solutions to Specific Accident(s) |
| <input type="checkbox"/> Protective Equipment to be Used | <input type="checkbox"/> Location of Emergency Telephone Number |
| <input type="checkbox"/> Emergency Hospital Route | <input type="checkbox"/> Work Schedule |
| <input type="checkbox"/> Other _____ | |

Do any items require assistance from BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☐ NO

NOTE: Place a copy of the completed form in the project file.

HS—17 REV. 06/98

**BROWN AND
CALDWELL**

Attachment C—Health and Safety Plan Safety Plan Implementation Checklist

Project Name LCP Chemicals Inc. Superfund Site	Project Location (city and state) Linden, NJ	Date
Name of Site Safety Coordinator Jennifer Potter	Weather Conditions	Project Number 21405

BC Staff Present	Name	Office

Indicate the status of each of the following:

- | | | | |
|--|------------------------------|-----------------------------|------------------------------|
| 1. Is a copy of the Health and Safety Plan (HASP) on site? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 2. Is the personal protective equipment required by the HASP available and being used correctly? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 3. Have the work zones been delineated? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 4. Has a decontamination station been set up as required by the HASP? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 5. Are the decontamination procedures being followed? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 6. Is access to the exclusion zone being controlled? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 7. Has the site activities briefing and tailgate safety meeting been provided? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 8. Is the list of emergency telephone numbers posted at the support zone? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 9. Are directions to nearest emergency medical assistance posted at support zone? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 10. Is emergency equipment available and functional, as required by the HASP? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 11. Has the nearest toilet facility been identified or a portable facility been set up? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 12. Has an adequate supply of drinking water been provided? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 13. Has water for decontamination been provided? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 14. Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the HASP? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 15. Are the instruments being used properly and periodically checked during the shift for battery charge status? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 16. Have the trenches and excavations been clearly marked? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 17. Have trenches and excavations been shored or sloped as required by soil type and work activities? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 18. Are dust suppression measures being used? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 19. Is food and tobacco consumption being restricted to the support zone? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 20. Has a confined space been identified as part of this project? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 21. Are the confined space entry procedures being correctly implemented? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| 22. Has the work/rest cycle for the shift been established? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |
| TIME ON (minutes): _____ TIME OFF (minutes): _____ | | | |
| 23. Has a shaded rest area been set up in the support zone? | <input type="checkbox"/> YES | <input type="checkbox"/> NO | <input type="checkbox"/> N/A |

NOTE: Place completed form in project file.

HS—18 REV. 06/98

**BROWN AND
CALDWELL**

Attachment D—Health and Safety Plan Notice of Unsafe Conditions

Contractor

Date

Project Name

LCP Chemicals, Inc. Superfund Site

Project Number

21405

THIS NOTICE . . .

This notice is to advise you, the Prime Contractor on the above-named Contract, that this Representative of the Owner of the above-mentioned Project has observed (on the date shown above) an unsafe condition on the Project.

These conditions are listed as follows:

ITEM

CONDITION

By this Notice, the Owner or its Representatives shall not assume any responsibility under the GENERAL CONDITIONS or assume any liability for the existence or correction thereof, for the unsafe conditions, or any others that may have been unnoticed.

These conditions shall be remedied as soon as possible within a safe working period. If these corrections are not made, the Owner will be forced to remove all field staff from the job. No payment shall be made for any work installed after this date without first examination of work in accordance with the GENERAL CONDITIONS.

Signature of Owner's Representative

Title

Date

Received by (Signature of Contractor's Representative)

Title

Date

NOTE: Place a copy of completed form in project file.

HS—19 REV. 06/98

**BROWN AND
CALDWELL**

Attachment—E Health and Safety Plan Environmental Monitoring Documentation

Project Name
LCP Chemicals, Inc. Superfund Site

Project Number
21405

Employee Name

Project Location
Linden, NJ

Equipment Used (check as appropriate)

	Calibrated	Date	Used	Dates(s)
OVA (Organic Vapor Analyzer)/FID	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____
OVM (Organic Vapor Monitor)/PID	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____
Jerome 431-XD Mercury Vapor Analyzer	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____
HNU	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____
PTLV Sniffer	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____
Photovac TIP	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____
Combustible Gas Meter/Explosimeter	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____
Other _____	<input type="checkbox"/>	_____	<input type="checkbox"/>	_____

Instrument	Date	Time	Readout Value	Area Monitored	Changes in PPE			User's Initials
					YES	NO	Type of PPE	

NOTE: Place completed form in project file.

HS—20 REV. 06/98

APPENDIX A

**PROCEDURES FOR FIELD OPERATION
OF PID AND MVA**

JEROME[®]
431-X[™]
MERCURY VAPOR ANALYZER
OPERATION MANUAL

September, 2000

Arizona Instrument LLC
1912 West 4th Street
Tempe, AZ 85281

(602)470-1414
800-528-7411
Fax(480)804-0656
<http://www.azic.com>

JEROME 431-X

Mercury Vapor Analyzer

Operation Manual

PROPRIETARY RIGHTS NOTICE

This manual contains valuable information and material developed by Arizona Instrument LLC for use with the Jerome 431-X Mercury Vapor Analyzer. No part of this manual can be reproduced or transmitted in any form or by any means, electronic, mechanical or otherwise without the express written permission of Arizona Instrument LLC. This includes photocopying and recording or in connection with any information storage or retrieval system

ALL RIGHTS RESERVED

© Copyright 2000, Arizona Instrument LLC
Mallcosorb™ is a registered trademark of Mallinckrodt.
Resisorb™ is a registered trademark of J.T. Baker Chemical Company.
Tygon™ is a registered trademark of Norton.

TABLE OF CONTENTS

FOR THOSE WHO CAN'T WAIT TO USE YOUR JEROME 431-X BEFORE READING THIS MANUAL	5
INTRODUCTION	6
Features of the 431-X	6
PRINCIPLES OF OPERATION	7
INSTRUMENT OPERATION	8
Digital Meter Display Codes	8
Daily Operations	9
Sensor Regeneration Instructions	10
Sample Mode	11
Sampling Notes	12
Survey Mode	12
Operating on AC Power or Generator	13
Operating on Internal Battery Power	13
Charging Batteries	13
Obtaining Maximum Battery Life	14
MAINTENANCE	14
Preventive Maintenance Calendar	14
Flow System	15
Internal Filters	16
Replacing Battery Pack	17
INTERNAL DIP SWITCH SETTINGS	18
Input Voltage and Frequency	18
Displaying Nanograms or Milligrams/Cubic Meter	18
Changing the Fuse	19
CALIBRATION	19
Verification of Calibration and Quality Control	19
431-X TROUBLESHOOTING	20
JEROME 431-X TECHNICAL SPECIFICATIONS	22
Optional "Communications" Version	22
Instrument I/O Interface	23
Potential Interferences	24

ACCESSORIES & MAINTENANCE PARTS	25
Accessory Kit, Y431-0901	25
Functional Test Kit, Y431-0902	25
Maintenance Kit, Y431-0903	26
Dosimeter Analysis Kit, Y431-0905	26
Accessories	27
Available but Not Shown	28
FACTORY CALIBRATION SERVICE	28
APPENDIX A , 431-X FUNCTIONAL TEST	29
Preparation	29
Mercury Transfer	30
Vessel Disassembly	30
Replacing Mercury	31
12.5 Syringe Technique	32
Functional Test Procedure	33
431-X Temperature Conversion Chart	35
Functional Test Troubleshooting	35
APPENDIX B - PERSONAL MERCURY DOSIMETER	36
Dosimeter Technical Specifications	36
Before Sampling with the Dosimeter	37
Dosimeter Analysis	38
Non-Standard Flow Rates and Dilution Modules	40
Dilution Module Ratio Check	41
Most Accurate Method	41
Loading the Dosimeter	42
Dilution Module Ratio Calculations	43
Analysis with a Dilution Module	44
APPENDIX C - INTERNAL DIP SWITCH SETTINGS	48
APPENDIX D - OPTION BOARD	49
Instrument Zeroing	50
Automatic Regeneration	50
15.4 DC Power Mode Enable	51
WARRANTY	52

FOR THOSE WHO CAN'T WAIT TO USE YOUR JEROME 431-X BEFORE READING THIS MANUAL

CAUTION: The Jerome 431-X is intended for vapor use only. **DO NOT** allow the probe or the instrument's intake to come in contact with liquids, dust or other foreign material.

Please read the manual for added details that will optimize the results and the life of your instrument or if your application requires use of dosimeters, special voltage inputs or data output. Also, refer to the manual for complete details on operation, maintenance and troubleshooting.

The Jerome 431-X is easy to operate and ready for use upon receipt from the factory. Follow these brief steps to use your instrument.

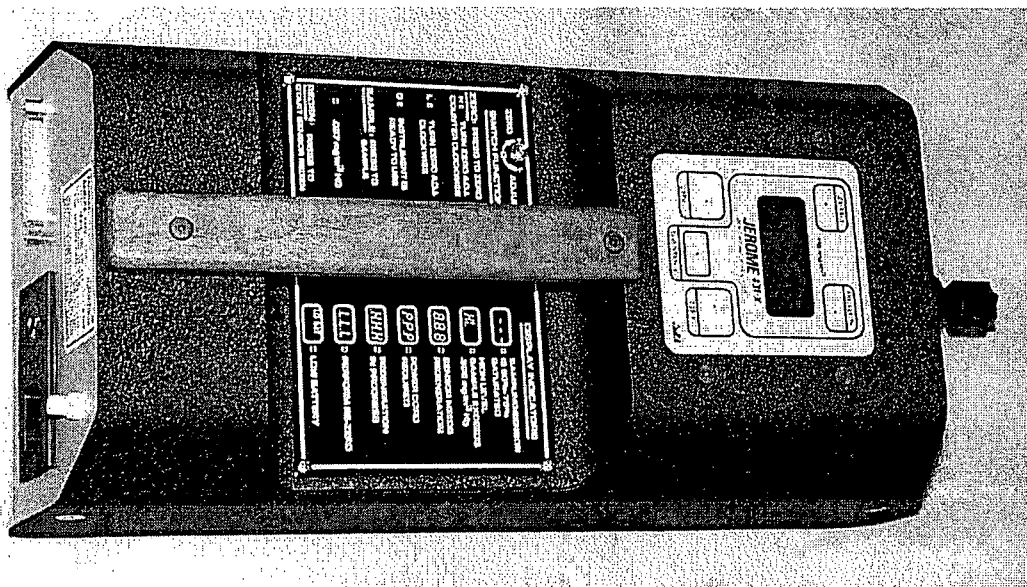
- Remove the instrument from the packing material. Check for any damage and confirm receipt of all parts on your packing list. Contact Arizona Instrument Customer Service at 800-528-7411 or 602-470-1414 if you have any questions.
- Press the ON button. In less than one second the display should read 000. Note that a LO BATT message appears briefly in the upper left corner. If the LO BATT light persists, charge the battery. See page 13 for details.
- Check the voltage setting (110 or 220 VAC) on the back of the instrument. Ensure that it is set to the correct voltage. If the voltage must be changed, turn the knob. However, it may also be necessary to change the frequency setting; see page 18 for details.
- Perform a sensor regeneration by following these steps:
 - Plug the line cord into the instrument using the plug in the back and to an AC power outlet.
 - Power the instrument ON and press the REGEN button. The instrument will begin a 10 minute regeneration cycle, indicated by .H.H.H flashing on the display. **Do not interrupt this cycle.** For a complete description of this process, see page 10.
 - If any error message, such as .H.L.P or .L.L.L appears on the display, see the Troubleshooting section on page 20.
- Adjust the sensor zero by pressing the ZERO button and turning the zero adjust screw located under the handle. Adjust until the display reads 0.
- The instrument is now ready to sample. Note that as the instrument measures mercury, the ZERO will display H. **Do not adjust the ZERO after the instrument has measured mercury and before the next regeneration.** (Occasionally the ZERO may drop to L (for low) between the initial zeroing and the first sample. It is OK to readjust the ZERO if the instrument has not measured mercury.)
- The instrument is designed for work space air monitoring. Press the SAMPLE button to start a 12 second sampling cycle.
- **DO NOT allow the probe or the instrument's intake to come in contact with liquids.**
- **Note that the instrument is not explosion proof.**
- After the day's survey, again perform a sensor regeneration. When complete, store the instrument with the zero air filter in the intake.

If you have any questions call AZI Customer Service, or your Technical Sales Representative, at 1-800-528-7411 or 1-602-470-1414

2 INTRODUCTION

The Jerome 431-X Gold Film Mercury Vapor Analyzer is designed for the easy and accurate analysis of mercury vapor in the workplace environment and for the location of mercury spills. The 431-X is easy to operate and has few maintenance requirements however, please take a moment to read this manual before attempting operation.

The Jerome 431-X is an ambient air analyzer with a range of 0.001 to 0.999 milligrams per cubic meter (mg/m³ Hg). If you have any questions about your application or operation, please call AZI Customer Service at 800-528-7411 or 602-470-1414 for assistance.



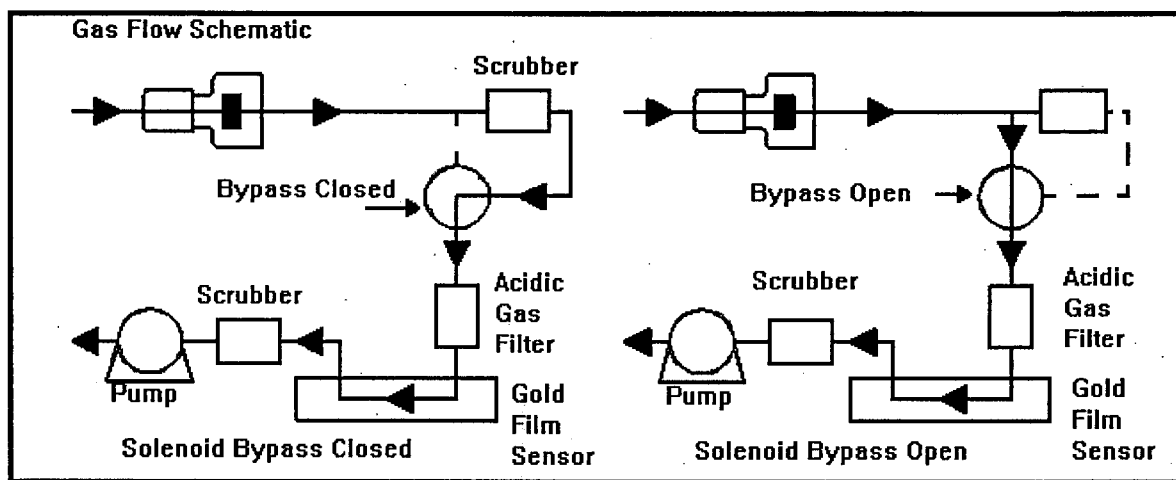
2.1 Features of the 431-X

- Automatic sensor regeneration when equipped with the communications option and used with the Jerome Communication Interface Software (JCI) program and the Jerome data logger.
- Regulated film heat voltage during sensor regeneration. This allows the sensor to clean properly with voltages from 100-130 VAC (or 200-260 VAC).
- Survey mode can be locked in.
- DIP switch setting can change the digital meter readings from mg/m³ Hg to nanograms (ng) of Hg (see page 18).
- The Jerome 431-X can be operated from 100-130 or 200-260 VAC. To change the default voltage range, refer to Setting the Input Voltage, page 18.

3 PRINCIPLES OF OPERATION

Mercury is unique in its ability to alter the resistance of a gold film. The 431-X sensor consists of two thin gold films, a reference and a sensor, configured in a Wheatstone Bridge Circuit, which detects very small changes in electrical resistance. The reference film is sealed and not exposed to mercury. The sensor film is exposed to mercury resulting in resistance changes, which are measured by the circuit. A microprocessor computes the concentration and displays the results.

Activating the SAMPLE mode starts an internal pump which draws air through a scrubber filter and into the flow system. After 2 seconds, the sample solenoid bypass opens, closing off the scrubber filter from the flow system. The sample air passes through a filter (removing any acidic gases which interfere with the sensor's response to mercury) and is drawn over the gold film sensor. The sensor adsorbs and integrates the mercury vapor. Nine seconds after starting, the sample solenoid bypass closes and the remainder of the sample is drawn through the scrubber filter and the flow system. The measured concentration is then displayed on the digital meter in milligrams per cubic meter (mg/m^3) of mercury. An internal DIP switch can be used to change the digital meter display from mg/m^3 to nanograms of mercury (see page 18).



The instrument's microprocessor automatically rezeroes the digital meter at the start of each sample cycle and retains the meter reading until the next sample cycle begins, thus eliminating drift between samples.

During the sample cycle, bars on the digital meter represent the percentage of sensor saturation. Approximately sixty-five samples containing $0.1 \text{ mg}/\text{m}^3 \text{ Hg}$ may be taken before the sensor reaches saturation. After absorbing approximately 500 nanograms of mercury, the sensor becomes saturated and needs to be cleaned. This is accomplished by a manually activated 10 minute heat cycle, or sensor regeneration which burns the mercury from the sensor. This mercury is absorbed on internal filters to prevent any external contamination. The solenoid bypass closes during the sensor regeneration cycle, causing the air to pass through the scrubber filter, providing clean air for the regeneration process. The flow system's final scrubber prevents contamination to the atmosphere from the desorbed mercury.

After a sensor regeneration, it is necessary to bring the two gold films back to a similar resistance. The ZERO button, along with the ZERO ADJUST potentiometer, are used to reset the sensor's reference film and sensor film to the same baseline. The sensor may exhibit some low level thermal drift after the regeneration cycle, due to heat generated during sensor regeneration. To ensure maximum sample accuracy, wait 30 minutes after a regeneration and then check the ZERO adjustment. If the display reads 0 when the ZERO button is pressed, the adjustment has been accomplished. If the display reads H or L, simply turn the ZERO ADJUST pot with the trimmer tool or small screwdriver to complete the adjustment.

Only adjust the ZERO pot after a regeneration. It is not necessary to rezero between samples since the instrument automatically erases the previous reading. If the ZERO ADJUST pot is manually turned between samples, the results will be slightly lower than the actual concentration. However, this is not a permanent problem and is corrected with a sensor regeneration.

4 INSTRUMENT OPERATION

4.1 Digital Meter Display Codes

METER DISPLAY	EXPLANATION
000	Ready to sample
.000	Lack of mercury reading
00.0	Lack of mercury reading, display in nanograms (see page 18)
.8.8.8	Perform sensor regeneration (refer to page 10)
.H.H.H	Sensor regeneration in progress (.H.H.H flashes)
.L.L.L	Perform re-zero (refer to page 10)
.P.P.P	Power cord required or low line power, <100 VAC (or 200 VAC)(see page 19, Changing the Fuse, if .P.P.P remains on after the cord is connected.)
.H.L.P	High line power, greater than 130 VAC (or 260 VAC)
.LO BAT	Recharge batteries (refer to page 13)
.E.E.E	Same as LO BAT, automatically shuts off
.HL	High level, sample exceeded maximum sample limit (.999)
DURING SAMPLING	
.-	0-25% sensor saturation
.--	25-50% sensor saturation
.---	50-75% sensor saturation
-.---	75-100% sensor saturation

DURING SAMPLING	USING THE SURVEY MODE
-	Survey sampling (minus sign flashes continuously)
WHEN ZERO IS DEPRESSED	Adjust to 0 <u>only</u> after sensor regeneration. It is normal for the display to read H after sampling has started.
0	Zero, ready to sample
H	High, turn Zero pot counterclockwise
L	Low, turn Zero pot clockwise

4.2 Daily Operations

Before each day's use of the Jerome 431-X, perform the following four steps to verify proper instrument operation:

- Press the power ON button.
 - The digital meter displays 000. (Disregard the digital meter's initial momentary reading.) Recharge or replace the battery pack if the LO BAT indicator REMAINS ON. Refer to pages 13 and/or 17 for the procedure.
 - To ensure the instrument's electronics have stabilized, allow a 1 minute warm up before beginning the next step.
- Perform a sensor regeneration. Refer to page 10 for the procedure. Thirty minutes after sensor regeneration is complete, rezero the instrument.



NOTE: For maximum accuracy, such as when testing with the Functional Test Kit, wait thirty minutes after the sensor regeneration cycle to rezero the unit. For emergency response, such as for spill cleanup, the unit can be rezeroed immediately after sensor regeneration

- Press the SAMPLE button.
 - During the sample cycle, the digital meter displays a bar (-) which indicates the amount of sensor saturation.
- At the end of the 12 second cycle, read the digital meter.
 - The number shown on the digital meter is the mercury concentration in mg/m^3 . This value remains on the display until the next sample is taken. The digital meter automatically zeroes at the start of each sample.
- At the end of each day's use perform a sensor regeneration. **DO NOT ALLOW MERCURY CONTAMINATION TO STAY ON THE GOLD FILM SENSOR OVERNIGHT.**

4.3 Sensor Regeneration Instructions

A sensor regeneration is needed to clear the 431-X sensor of any accumulated mercury and to prolong the life of the sensor. This simple procedure should be done:

- At the beginning of the day on which the instrument is to be used.
- During the mercury survey, if the sensor becomes saturated.
- At the end of the day's survey, before storage.
- At a minimum of every 30 days while the instrument is in storage. Regeneration once each month will prolong the life of the gold film sensor.

See the Principles section on page 7 for more details on the gold film sensor and the sensor regeneration.

AC power must be between 100-130 VAC or 200-260 VAC for the sensor to clean properly. If AC power is not between these limits, an .P.P.P or .H.L.P may appear in the display (see page 8). Refer to page 18 for voltage and frequency settings.

CAUTION: Once a sensor regeneration is initiated, **DO NOT** interrupt the cycle.

- Attach the power cord to the 431-X and plug it into AC power. AC power is required to thermally regenerate the sensor.
- Press the power ON button.
- Press the REGEN button.
 - The digital meter flashes .H.H.H for the duration of the 10 minute cycle and displays .0.0.0 when the cycle is completed.
 - **DO NOT INTERRUPT THIS CYCLE.** Wait until the cycle is completed before continuing with the next step.

NOTE: The digital meter will read .P.P.P after REGEN is activated if the power cord is not plugged in or if the instrument's fuse needs replacing. Plug in the power cord, or if necessary, replace the fuse according to the procedure on page 19.

- While pressing the ZERO button, turn the ZERO ADJUST potentiometer using the trimmer tool until the digital meter reads 0. See the illustration on page 6 for the location of the ZERO ADJUST potentiometer.
 - If the meter reads H, turn the ZERO ADJUST counter-clockwise;
 - If the meter reads L, turn the ZERO ADJUST clockwise.

NOTE: A minimum 30 minute wait after the sensor regeneration cycle is complete ensures maximum sample accuracy. However, the unit can be used immediately following the sensor regeneration if necessary. When the sensor regeneration is complete, press ZERO and adjust the ZERO ADJUST pot until 0 appears on the display. Install the zero air filter in the intake and take several samples or lock the instrument into survey mode (see page 12). After approximately one minute, stop sampling and check the ZERO. Adjust to 0. Repeat sampling through the zero air filter until sensor remains on 0.

NOTE: Depending upon internal configuration, a number between 00 and 100 may appear on the display, instead of H, L, or O when zero is pressed. See Internal Dip Switch Settings, page 18, for details. **IMPORTANT: Do not turn the ZERO ADJUST potentiometer between samples.** Turn the ZERO ADJUST only after a sensor regeneration cycle otherwise invalid readings will result.

- Press the power OFF button and disconnect the power cord.
- The Jerome 431-X is ready for sampling.

4.4 Sample Mode

This mode, used for standard operation, produces optimum accuracy (+/-5% at 0.100 mg/m³ Hg) with the Jerome 431-X.

- Press the power ON button.
 - The digital meter displays 000. If the unit is set to display in ng, the digital meter displays 00.0. (Disregard the digital meter's initial momentary readings.) Recharge or replace the battery pack if the LO BAT indicator REMAINS ON. Refer to pages 13 and/or 17 for the procedure.
- To ensure the instrument's electronics have stabilized, allow a 1 minute warm up before beginning the next step.
- Press the SAMPLE button.
 - During the sampling cycle, the bar (or bars) shown on the digital display indicate the current percentage of sensor saturation. (Refer to Meter Display Codes, page 8, for code descriptions.)
 - The bar (or bars) flash after 2 seconds and again after an additional 7 seconds. This flashing signals the opening and closing of the solenoid sample bypass. (See the Principles of Operation on page 7 for details.)
- At the end of the 12 second cycle, read the digital meter.
 - The number shown on the digital meter is the mercury concentration in mg/m³ (or ng). This value remains displayed until the next sample is taken. The digital meter automatically zeroes at the start of each sample.
- When the sensor is completely saturated, the digital meter displays .8.8.8 instead of a value. No further operation is possible until a sensor regeneration is performed. (Refer to page 10 for the Sensor Regeneration procedure.)
- Press the power OFF button when not in use. Install the zero air filter in the instrument intake during storage.

4.5 Sampling Notes

- The Jerome 431-X is intended for vapor use only. **DO NOT** allow the probe or the instrument's intake to come in contact with liquids, dust or other foreign material. Moisture or liquids drawn into the instrument can damage the sensor and flow system.
- The Jerome 431-X operates a minimum of 6 hours on a fully charged battery.
- Use the probe (AZI P/N1400-2002) to locate mercury vapor in hard to reach places. Plug the probe directly into the instrument's intake.

4.6 Survey Mode

The survey mode takes samples every 3 seconds automatically. Use this mode to locate mercury spills or to assess areas of potentially high mercury concentrations. Sampling in the survey mode is not as accurate. Due to the decreased sample volume, the accuracy of the instrument is reduced to +/- 20% @ .100 mg/m³.

- Press the power ON button.
 - The digital meter displays 000. If the unit is set to display in ng, the digital meter displays 00.0. (Disregard the digital meter's initial momentary readings.) Recharge or replace the battery pack if the LO BAT indicator REMAINS ON. Refer to pages 13 and/or 17 for the procedure.
 - To ensure the instrument's electronics have stabilized, allow a 1 minute warm up before beginning the next step.
- Press and **hold** the SAMPLE button.
 - The instrument takes a normal 12 second sample, displays the concentration at the end of the cycle and then goes into the survey mode sampling every 3 seconds. The display flashes the measured concentrations at the end of each 3 second sample cycle.
- When you are finished surveying, **release** the SAMPLE button.
 - The final survey value remains displayed until the next sample is taken.

<p>NOTE: Approximately 65 samples at .1 mg/m³ may be taken before a sensor regeneration is required.</p>
--

- **To lock the instrument in a survey mode:**
 - Hold the SAMPLE button down until the sensor status indicator bar(s) "_" begins flashing on the display.
 - Press the ZERO button, then release the SAMPLE button.
 - The pump should continue to run and the display should update every 3 seconds.
 - The instrument remains in the survey mode until one of the following occurs:
 - The sensor is saturated
 - A LO BAT (low battery) signal is encountered
 - An HL (high mercury level) is encountered
 - The instrument is turned OFF.
- Press the power OFF button when not in use.

4.7 Operating on AC Power or Generator

For stationary use, the 431-X may be operated on AC power. Operating the instrument only on AC power eliminates the need for the battery pack and its necessary maintenance. If preferred, the battery may be unplugged or removed completely.

When using a generator to power the Jerome 431-X, it is important that the generator is capable of maintaining a constant voltage output. **This is especially true during the sensor regeneration.** Use a high quality line conditioner or voltage regulator to prevent damage to the electronic components and the sensitive gold film sensor.

4.8 Operating on Internal Battery Power

Battery power allows use of the Jerome 431-X as a portable instrument. If battery power is necessary for use, please be aware of the following:

- A fully charged battery pack (AZI P/N Z4000-0907) provides power for a minimum of 6 hours of operation.
- For operating more than 6 hours, an extra fully charged battery pack is needed.
- Complete battery recharging takes 14 hours. Refer to page 13, Charging Batteries for instructions if needed.
- The 431-X use a rechargeable NiCad battery. Dispose of the old battery properly when it is replaced with a new one.
- **External battery power:** A special version of the Jerome 431-X is available that can be operated from a secondary DC source, such as a battery used in conjunction with solar panels. Contact AZI for additional information.

4.9 Charging Batteries

- Press the power OFF button.
- Attach the power cord to the 431-X and plug it into AC power.
- *Complete battery recharging takes 14 hours.*
- *The 431-X contains a trickle charger so it may be continually plugged into an AC power source without damaging the battery pack.*

<p>NOTE: To charge the batteries outside of the instrument, use the IDC Battery Charger (AZI P/N 4000-1011, for 115 VAC, P/N 4000-1012, for 230 VAC).</p>
--

4.10 Obtaining Maximum Battery Life

There are certain inherent limitations to NiCad (Nickel Cadmium) batteries. The primary limitation is a memory effect that occurs when the batteries are partially discharged and then recharged, repeatedly. This memory leads to a drastic reduction in the usable battery life. To prevent this memory effect, periodically allow the battery pack to discharge completely, then recharge the battery pack.

- For maximum battery life, follow these 3 steps:
 - At least once a month wait until LO BAT appears on the digital meter before recharging the battery pack.
 - Charge the battery pack when the LO BAT indicator comes on. Excessive discharge can damage the battery pack. Before storing the instrument verify the power is OFF.
- When batteries fail to hold a charge, the battery pack should be replaced. Battery life under normal usage is approximately 1 year, depending on the number of charge and discharge cycles.

5 MAINTENANCE

5.1 Preventive Maintenance Calendar

To keep the Jerome 431-X operating at peak performance, follow the maintenance schedule below. Use this schedule as a guideline only, as maintenance is more a function of application and amount of use, rather than time.

ALWAYS install the zero air filter into the instrument's intake during storage.

PART/COMPONENT	MAINTENANCE CYCLE	PAGE
Charge batteries	At least once per month, after one month's storage, or when LO BAT appears	13
Change .25mm fritware	Weekly or as needed	15
Change internal filters*	After 6 months of use or as needed.	16
Replace zero air filter*	Annually	16
Factory calibration	Annually	19
Calibration check	Monthly or as needed	29
Replace batteries	Annually or as needed The battery pack contains NiCad batteries. Dispose of them properly.	17

* C/M filters contain Mallcosorb™, Scrubber filters and zero air filters contain Resisorb™. For safety information, see the supplier's Material Safety Data Sheets (MSDS) or call AZI Customer Service at 1-800-528-7411 or 1-602-470-1414 for assistance in obtaining the MSDS. Dispose of all filters properly.

5.2 Flow System

The Jerome 431-X's flow system is the crucial link between the sensor and the sample. For the instrument to perform correctly, the flow system must be properly maintained. The user maintainable components of this system are the intake filter (.25 mm fritware), a C/M filter, two scrubber filters and connecting tubing.

Check the Preventive Maintenance Calendar, page 14, for a suggested schedule for changing filter disc and filters. The Tygon™ tubing in the system must be free of crimps for proper flow.

- Replace the .25mm Fritware once each week. In dusty environments, the fritware may need replacement as often as once a day. Replacement .25mm Fritware are available from AZI, Technical Sales, 1-800-528-7411 or 1-602-470-1414, (see Accessories & Maintenance Parts on page 25).
 - Unscrew and remove the intake from the instrument.
 - Push the old fritware disc out using your trimmer tool.
 - Use tweezers to insert the new fritware. Avoid touching the new fritware disc with fingers.
 - Use the blunt end of the trimmer tool to seat the fritware disc firmly against the inner ledge of the intake.
 - Screw the intake back on the instrument.

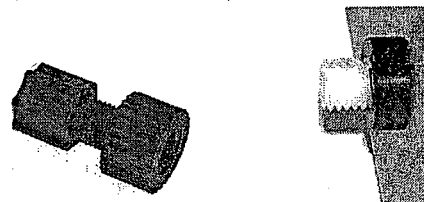


Figure 4 Remove Intake



Figure 5 Insert Fritware

Figure 6 Remove Fritware

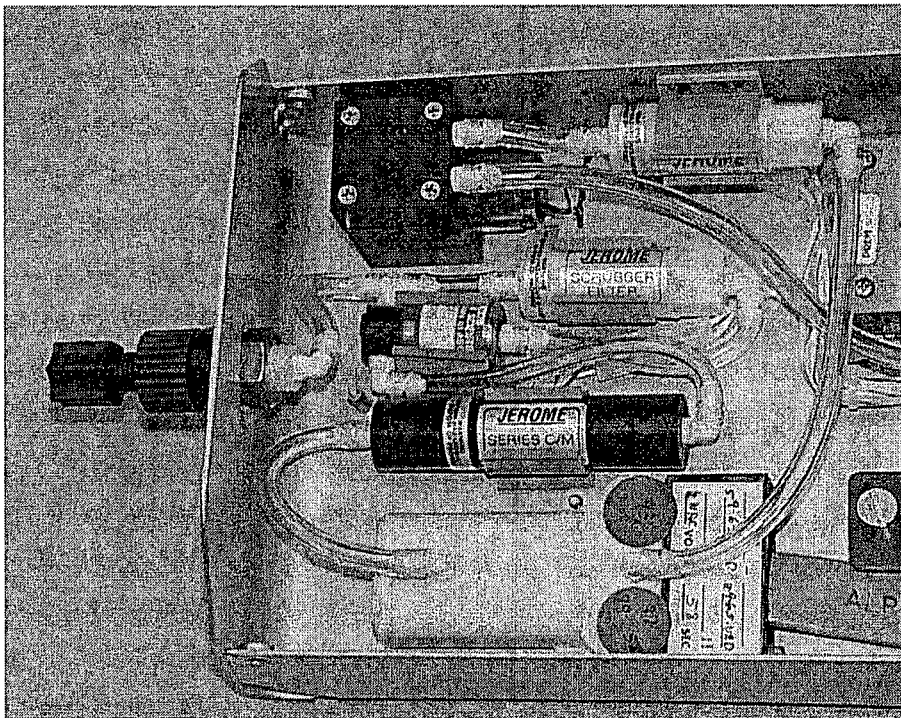
CAUTION

The air flow intake, on the front of the instrument, must be securely held in place. If it is loose, the tubing inside the instrument can become twisted when the intake housing is replaced. On older instruments, it may be necessary to open the instrument and tighten the retaining nuts from the inside. Call AZI Customer Service at 1-800-528-7411 or 1-602-470-1414 if you have any questions.

5.3 Internal Filters

Replace the internal filters system (one C/M filter and two scrubber filters) after six (6) months of use, or as needed. (See Troubleshooting section, page 20.)

- Press the power OFF button and unplug the power cord.
- Remove the 2 side screws from the intake end of the instrument and open the case.
- Carefully disconnect the Tygon™ tubing from both ends of the filters and discard the old filters.



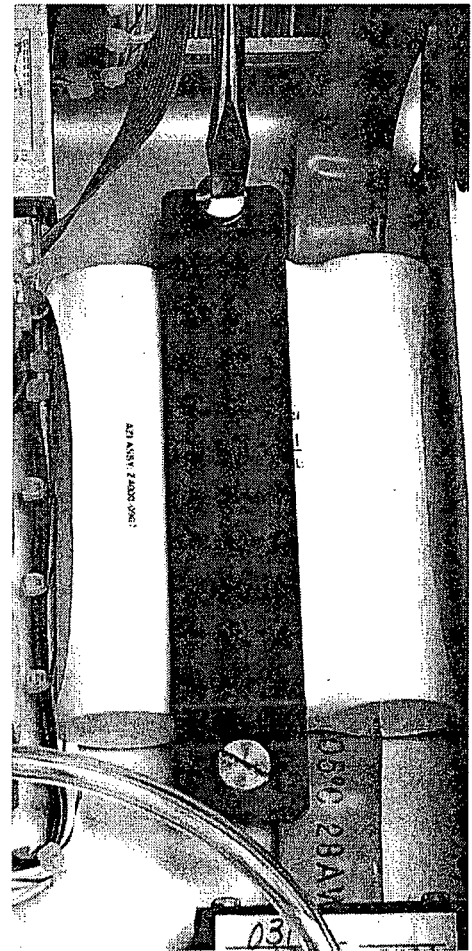
CAUTION:

The Series C/M filter contains Mallcosorb™ and the Scrubber Filters contain Resisorb™. Both types contain trace amounts of mercury. For safety information, see the supplier's Material Safety Data Sheets (MSDS) or call AZI Customer Service at 1-800-528-7411 or 1-602-470-1414 for assistance in obtaining the MSDS. Use proper disposal methods for all filters.

- Connect the new filters to the Tygon™ tubing, ensuring all filter straight nipples point toward the intake and elbows point according to the illustration.
 - Push the Tygon™ as far as it will go onto the filter fittings.
- Push the filters into the mounting clips.
- Remove any crimps in the tubing and ensure that tubing connections are secure.
- Close the case and replace the screws.
- Dispose of all filters in accordance with State and Federal EPA Regulations.

5.4 Replacing Battery Pack

- Press the power OFF button.
- Unplug the power cord.
- Remove the screws, one on each side, from the intake end of the instrument and open the case lid.
- Disconnect the battery connector from the board.
- Loosen the two (2) captive screws holding the battery bracket and remove the bracket.
- Remove the old battery pack and replace it with a new battery pack.
- Replace the battery bracket and tighten the captive screws.
- Connect the new battery connector to the board.
- Close the case and replace the screws.
- Dispose of the old NiCad battery properly, in accordance with State and Federal EPA Regulations.



6.3 Changing the Fuse

If the instrument display reads .P.P.P when the instrument is connected to AC power or when REGEN is pressed, or if the battery will not charge, the fuse may need to be replaced. The AC line power could also be less than 100 VAC (220 VAC). Check the fuse with an ohm meter and/or the AC line power with a voltage meter.

- Locate the power receptacle on the rear of the instrument.
- Insert a small screwdriver in the slot and gently slide the fuse compartment out.
- Check the fuse held in the open sided clip and if it is bad, replace it with the spare fuse held in the sliding spare fuse compartment. Discard the bad fuse.
 - When it is convenient, replace the spare fuse with another 1A 250V Fast-Blo fuse (AZI P/N 5100-1012).
- Replace the fuse compartment in the power receptacle.



7 CALIBRATION

The Jerome 431-X's gold film sensor is inherently stable and does not require frequent calibration. The interval between calibrations depends upon the application and frequency of use; however, the recommended minimum or maximum interval is every 12 months.

The Jerome 431-X has been factory calibrated using NIST traceable permeation tubes. In order to calibrate the Jerome 431-X, a sophisticated calibration system is required that ensures stability of the calibration gas source, eliminates any pressure in the calibration gas stream and controls the temperature of the calibration environment. Calibration also requires special proprietary software. This system has an estimated uncertainty of $\pm 3.5\%$.

We strongly recommend you take advantage of our calibration and maintenance service at Arizona Instrument. A certificate of calibration is issued by Arizona Instrument when your instrument is factory calibrated to 0.100 mg/m^3 . Two additional calibration points, 0.010 and 0.025 mg/m^3 , are available upon request at additional charge. Contact Arizona Instrument Customer Service at 1-800-528-7411 or 1-602-470-1414 for assistance in obtaining calibration.

7.1 Verification of Calibration and Quality Control

The Functional Test Kit, AZI P/N 4431-0902, is used to determine if your instrument is within calibration tolerances between recommended annual factory calibrations. If your application requires frequent verification of instrument function, this test demonstrates the unit's operation, calibration, and function. This test verifies proper instrument operation through the introduction of a known mass of mercury into the Jerome analyzer and allows you to have complete confidence in the sample results.

Recording the Functional Test Kit results in an instrument log provides a quality control/quality assurance record of instrument function between regular calibrations. As long as the test results fall within the expected range, you may assume the instrument is functioning correctly.

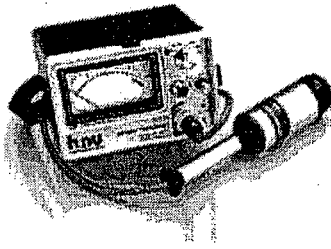
THIS FUNCTIONAL TEST DOES NOT CALIBRATE THE INSTRUMENT.

A complete description of the Functional Test Kit procedures is contained in Appendix A, beginning on page 29.

To order the kit, contact Arizona Instrument Technical Sales at 1-800-390-1414 or 1-602-470-1414.

8 431-X TROUBLESHOOTING

Symptom	Possible Cause	Solution
Power Problems		
Unit does not turn ON. LCD displays 000 when connected to power cord and ON button is pressed.	Dead battery	Recharge battery (minimum 14 hours) refer to page 13. Replace battery, refer to page 17.
Unit does not turn on when connected to AC power cord.	Fuse Insufficient power	Replace fuse, refer to page 19 . Be sure there is power to the AC outlet using a volt meter.
Regeneration & zero problems		
LCD displays .8.8.8.	Sensor saturated	Do not attempt to rezero. Unit must be regenerated. See page 10 for information.
LCD displays .L.L.L when taking first sample.	Changes in temperature	Readjust zero pot. See page 6 for information .
LCD displays H at finish of sensor regeneration	Internal contamination may redeposit mercury from flow system onto gold film sensor.	Remove and replace intake filter disk, Tygon™ tubing and internal C/M filter. Check tubing for kinks or crimps. Repeat regeneration cycle. See page 10 for information.
Zero adjust pot cannot be adjusted to 0	Pot not turned sufficiently	Turn zero adjust up to 20 times to reach the end. Pot will "click" softly.
Display still unchanged	Sensor may be ruptured or pot may be broken	Turn pot slowly in opposite direction till display reads 0. If still unchanged, call AZI Customer Service.

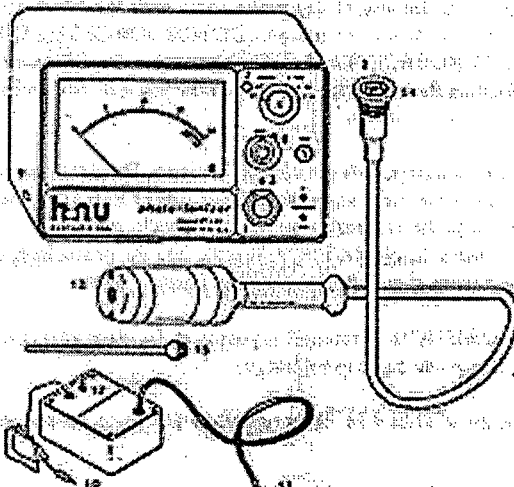


MODEL PI-101
Quick-Start
Manual



MODEL PI-101

readout module



1. 12-pin receptacle
2. 12-pin connector
3. high voltage switch
4. function switch
5. zero knob
6. span control
7. low battery indicator, LED
8. meter
9. charger minijack
10. charger miniplug
11. charger power cord
12. charger, LED
13. probe sample inlet
14. connector adapter ring
15. probe extension

Figure 1

PREPARING FOR FIELD USE

Attach the probe to the readout module. Align the slot on the 12-pin connector (2) at the end of the probe cable with the tab in the 12-pin receptacle (1) on the readout module. **DO NOT FORCE THE CONNECTOR INTO THE RECEPTACLE.** Once you insert the connector into the receptacle, turn the connector clockwise until you hear and feel a distinct click.

Turn the function switch (4) to the **BATT** position. The meter needle should deflect to the green area at the right-hand side of the meter scale plate. Listen to the probe and make sure that the fan is operating; it makes a humming sound. Look **BRIEFLY** directly into the probe inlet (13) and observe the lamp glow, which appears as a purple light.

CAUTION: Prolonged exposure to the ultraviolet rays of the lamp can cause eye damage.

The lamp glow cannot be observed when the probe extension (15) is attached.

Turn the function switch (4) to the **STANDBY** position. The fan operates and the lamp is off. The meter needle moves to the left out of the green area on the meter scale plate. Turn the zero knob (4) until the meter needle rests at 0. (The PI-101 can be electronically zeroed only while the function switch is in the **STANDBY** position).

Check the span setting (1.0 for 9.5 eV lamps, 9.8 for 10.2 eV lamps, 5.0 for 11.7 eV lamps) and adjust as necessary using the span control (6). Connect the regulator to the calibration gas canister (see figure 2). Using flexible tubing (three inches long is sufficient, one quarter inch diameter), connect the calibration gas to the probe inlet (13, Figure 1), and open the valve on the regulator. Use of the probe extension (15, Figure 1) is optional during this procedure. Recheck the electronic zero and adjust as necessary.

Once the PI-101 is electronically zeroed, turn the function switch (3, Figure 1) to the 0-2000 range position (X100).

CALIBRATION TEST SET-UP

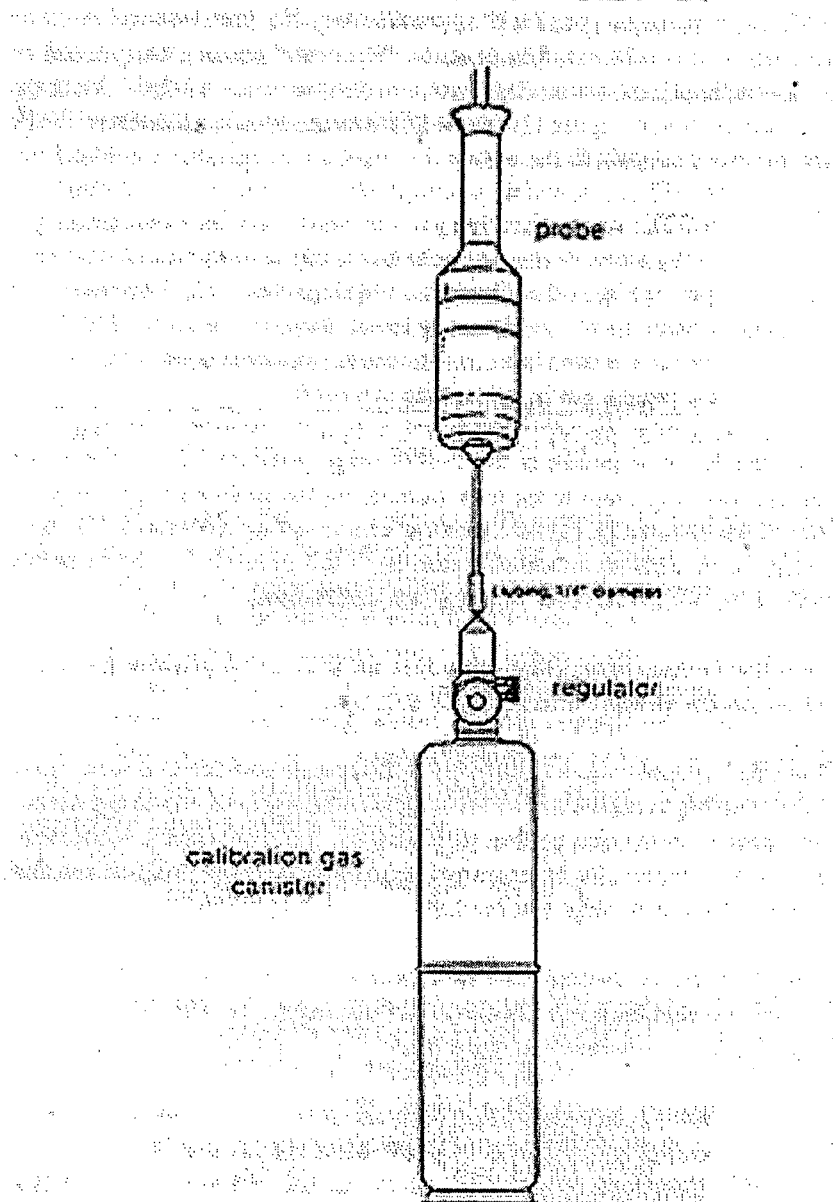


Figure 2

CALIBRATION

HNU calibration gas consists of approximately 100 ppm isobutylene in an air matrix; it is referenced to benzene. The meter reading that should be obtained during calibration is marked on the gas canister label.² With the function switch (4, Figure 1) at the 0-2000 range position, the meter needle should move slightly to the right.

NOTE: Any calibration gas used must have the same matrix gas as the atmosphere in which the PI-101 is used. Use of any other gas significantly affects the readings obtained. Readings may appear to be far higher or lower than they actually are. If the monitor is used in air, never use N_2 or any gas other than air, as the matrix gas in calibration standards.

Turn the function switch to the 0-200 range position (X10). The meter should read very close to the ppm number on the calibration gas canister. Adjust the span pot (6, Figure 1) until an exact reading is obtained. The span setting used to obtain an accurate reading in this procedure is the reference point from which all other readings are determined.

Turn the function switch (4, Figure 1) to the 0-20 range position (X1). The meter needle should deflect fully to the right.

Turn the function switch back to the 0-200 range position and recheck the meter reading to ensure that an accurate reading has held. Make any needed adjustments to the span control (6, Figure 1), and if necessary, recheck the accuracy by turning the function switch to the 0-20 range position and then back to the 0-200 range position.

Turn the function switch to the OFF position. Close the valve on the calibration gas regulator and disconnect it from the probe inlet (13, Figure 1). The PI-101 is now ready for field use.

NOTE: High humidity (90% and above) affects sensitivity. This should be taken into account when calibrating. Readings may appear to be lower than actual, but use of a humid air matrix in the calibration standard minimizes this effect.

CHARGING, (CONT.)

NOTE: If the particular PI-101 unit is a **GP PI-101** (General Purpose), it is not necessary that the probe be attached during the charging process. This is **ONLY** true for GP PI-101 units. All other types of PI-101 units **MUST** have the probe attached during the charging process.

The PI-101 can be left on charge whenever it is not in use. It cannot overcharge. The PI-101 can be operated when attached to the charger, however, charging time is longer than eight to ten hours.

QUICK CHECKS

Charge did not "take". Is the probe attached? Is the high voltage switch completely depressed? Is the charger LED on? Is the charger output -15 VDC?

To check the charger output, use a voltmeter. The charger must be connected to an AC power supply during this process. Place the black (common) lead on the miniplug on the sleeve. Place the red (positive) lead on the tip of the miniplug. The correct voltage is +/- 15 VDC. If a positive voltage is read at this point, check the position of the voltmeter leads.

For more detailed information on the PI-101, consult the complete PI-101 manual, or contact HNU Systems, Inc.

¹ The probe extension may become contaminated during normal use and must be cleaned periodically. Use the same procedure as for ion chamber cleaning, which is described in Service Note 86-01 (included in this booklet). If the probe extension is used during calibration, it should be free of any contaminants to ensure an accurate calibration.

² Most calibration gas canisters supplied by HNU Systems, Inc., have a label stating a particular ppm to be read with a span setting of 9.8. This is the recommended span setting for the 10.2 eV lamp **ONLY**, which is the most commonly used lamp. Be sure to use the span setting recommended for the particular lamp that is used during the calibration; 1.0 for 9.5 eV lamps, 9.8 for 10.2 eV lamps, and 5.0 for 11.7 eV lamps.

FAN CLEANING

NEEDED:

Flat Screwdriver
Cotton Swabs
Clean Water

DISASSEMBLY

Hold the probe with the cable up. With one hand supporting the end of the probe, remove the exhaust screw, located next to the cable. Gently slide the lamp housing out of the probe shell. Set the shell aside. Working on a flat surface, place the probe end down with the small printed circuit board upwards and facing you. Unplug the signal cable (#5) from the connector on the board. Remove the small screw holding the board in place (#4). Remove the board and set aside. Turn the housing around so that the flat side of the semicircular retainer (#1), is facing away. Remove the two standoff screws (#2). Gently grasp the copper-clad fan motor (#3) and retainer. Tilt the top away and the bottom towards you so that the fan blades are exposed.

CLEANING

Blow into the fan blades to remove any debris that may prevent their movement. If this does not free the blades, remove about 2/3 of the cotton from a swab, dampen it with clean water, and gently dab at and between the fan blades. Repeat as necessary. Allow a few minutes for the water to dry off.

REASSEMBLY

Replace the fan with the blades face down in the circular output on the lamp housing. Replace the retainer and the two standoff screws. Tighten the screws enough to retain the fan cylinder, but loose enough to allow very slight rotation. Turn the housing around so that the flat side of the retainer is facing you. Replace the printed circuit board and secure with the small screw. Plug the signal cable onto the board. Slide the housing into the shell. DO NOT FORCE IT IN. The housing fan fits into the shell only one way. The hole on the retainer must line up with the hole on the shell next to the cable. Replace the exhaust screw. Except for two small standoff screws, all other screws should be hand tight.

PROBE ASSEMBLY

The diagram illustrates the assembly of a probe. The main components and their labels are as follows:

- Probe Assembly (the main cylindrical body)
- Probe Seal (a small O-ring)
- Probe Seal (a larger O-ring)
- Probe Seal (a third O-ring)
- Probe Seal (a fourth O-ring)
- Probe Seal (a fifth O-ring)
- Probe Seal (a sixth O-ring)
- Probe Seal (a seventh O-ring)
- Probe Seal (an eighth O-ring)
- Probe Seal (a ninth O-ring)
- Probe Seal (a tenth O-ring)
- Probe Seal (an eleventh O-ring)
- Probe Seal (a twelfth O-ring)
- Probe Seal (a thirteenth O-ring)
- Probe Seal (a fourteenth O-ring)
- Probe Seal (a fifteenth O-ring)
- Probe Seal (a sixteenth O-ring)
- Probe Seal (a seventeenth O-ring)
- Probe Seal (an eighteenth O-ring)
- Probe Seal (a nineteenth O-ring)
- Probe Seal (a twentieth O-ring)
- Probe Seal (a twenty-first O-ring)
- Probe Seal (a twenty-second O-ring)
- Probe Seal (a twenty-third O-ring)
- Probe Seal (a twenty-fourth O-ring)
- Probe Seal (a twenty-fifth O-ring)
- Probe Seal (a twenty-sixth O-ring)
- Probe Seal (a twenty-seventh O-ring)
- Probe Seal (a twenty-eighth O-ring)
- Probe Seal (a twenty-ninth O-ring)
- Probe Seal (a thirtieth O-ring)
- Probe Seal (a thirty-first O-ring)
- Probe Seal (a thirty-second O-ring)
- Probe Seal (a thirty-third O-ring)
- Probe Seal (a thirty-fourth O-ring)
- Probe Seal (a thirty-fifth O-ring)
- Probe Seal (a thirty-sixth O-ring)
- Probe Seal (a thirty-seventh O-ring)
- Probe Seal (a thirty-eighth O-ring)
- Probe Seal (a thirty-ninth O-ring)
- Probe Seal (a fortieth O-ring)
- Probe Seal (a forty-first O-ring)
- Probe Seal (a forty-second O-ring)
- Probe Seal (a forty-third O-ring)
- Probe Seal (a forty-fourth O-ring)
- Probe Seal (a forty-fifth O-ring)
- Probe Seal (a forty-sixth O-ring)
- Probe Seal (a forty-seventh O-ring)
- Probe Seal (a forty-eighth O-ring)
- Probe Seal (a forty-ninth O-ring)
- Probe Seal (a fiftieth O-ring)
- Probe Seal (a fifty-first O-ring)
- Probe Seal (a fifty-second O-ring)
- Probe Seal (a fifty-third O-ring)
- Probe Seal (a fifty-fourth O-ring)
- Probe Seal (a fifty-fifth O-ring)
- Probe Seal (a fifty-sixth O-ring)
- Probe Seal (a fifty-seventh O-ring)
- Probe Seal (a fifty-eighth O-ring)
- Probe Seal (a fifty-ninth O-ring)
- Probe Seal (a sixtieth O-ring)
- Probe Seal (a sixty-first O-ring)
- Probe Seal (a sixty-second O-ring)
- Probe Seal (a sixty-third O-ring)
- Probe Seal (a sixty-fourth O-ring)
- Probe Seal (a sixty-fifth O-ring)
- Probe Seal (a sixty-sixth O-ring)
- Probe Seal (a sixty-seventh O-ring)
- Probe Seal (a sixty-eighth O-ring)
- Probe Seal (a sixty-ninth O-ring)
- Probe Seal (a seventieth O-ring)
- Probe Seal (a seventy-first O-ring)
- Probe Seal (a seventy-second O-ring)
- Probe Seal (a seventy-third O-ring)
- Probe Seal (a seventy-fourth O-ring)
- Probe Seal (a seventy-fifth O-ring)
- Probe Seal (a seventy-sixth O-ring)
- Probe Seal (a seventy-seventh O-ring)
- Probe Seal (a seventy-eighth O-ring)
- Probe Seal (a seventy-ninth O-ring)
- Probe Seal (a eightieth O-ring)
- Probe Seal (a eighty-first O-ring)
- Probe Seal (a eighty-second O-ring)
- Probe Seal (a eighty-third O-ring)
- Probe Seal (a eighty-fourth O-ring)
- Probe Seal (a eighty-fifth O-ring)
- Probe Seal (a eighty-sixth O-ring)
- Probe Seal (a eighty-seventh O-ring)
- Probe Seal (a eighty-eighth O-ring)
- Probe Seal (a eighty-ninth O-ring)
- Probe Seal (a ninetieth O-ring)
- Probe Seal (a ninety-first O-ring)
- Probe Seal (a ninety-second O-ring)
- Probe Seal (a ninety-third O-ring)
- Probe Seal (a ninety-fourth O-ring)
- Probe Seal (a ninety-fifth O-ring)
- Probe Seal (a ninety-sixth O-ring)
- Probe Seal (a ninety-seventh O-ring)
- Probe Seal (a ninety-eighth O-ring)
- Probe Seal (a ninety-ninth O-ring)
- Probe Seal (a hundredth O-ring)

Figure 3

Figure 3

APPENDIX B

DECONTAMINATION PROCEDURES

405. DECONTAMINATION

405.1 Purpose

Personnel engaged in investigations or clean-up of sites for hazardous materials can become contaminated in several ways, including being splashed with liquid chemical products or contaminated water while drilling, developing, testing, and sampling wells; handling chemical wastes, contaminated soil or water, or contaminated equipment; walking on contaminated soil or through contaminated surface water; and contacting chemical vapors, dusts, fumes, and mists. Although protective clothing helps prevent the wearer from becoming contaminated, contamination can occur. Decontamination reduces dermal exposure time. It also prevents hazardous materials from being transferred from protective clothing to wearer and to clean areas where unprotected individuals can be exposed.

Decontamination consists of removing contaminated clothing and washing the skin to remove contaminants. How extensive the decontamination process must be depends primarily on the types of contaminants and the nature of on-site activities planned. As the toxicity of the contaminants and the magnitude of potential contamination of personnel are increased, the decontamination process becomes increasingly more extensive and thorough. This OP describes decontamination guidelines while procedures for field operations must be developed on a site-by site basis.

405.2 Responsible Authority

Decontamination operations at each hazardous waste site shall be supervised by the SSO. The SSO is responsible for ensuring that all personnel follow decontamination procedures and that all contaminated equipment is adequately decontaminated. The SSO is also responsible for maintaining the decontamination zone and managing the wastes generated from the decontamination process.

405.3 Decontamination of Personnel

Site activities should be conducted with the general goal of preventing the contamination of people and equipment. Using remote sampling techniques, bagging monitoring instruments, avoiding contact with obvious contamination, and employing dust suppression methods that would reduce the probability of becoming contaminated and, therefore, reduce the need and extent of decontamination. However, some type of decontamination will always be required on site. A sample personnel decontamination set-up guideline is included provided in Attachment 1 and sample decontamination equipment and supplies list is included in Attachment 2.

OSHA requires that proper PPE must be worn when operating steam or pressure washing equipment. A rain suit, boots, hard hat, and a face shield are recommended to be worn. Depending on the contaminant, a respirator is usually worn. All personnel must be kept out of the path of steam or water spray.

Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potential harmful effects of exposures to hazardous substances.

OSHA also requires that when hazardous waste clean-up or removal operation commences on a site and the duration of the work will require six months or greater time to complete, showers and change rooms must be provided for all employees exposed to hazardous substances and health hazards involved in hazardous waste clean-up or removal operations. It must be assured that employees will shower at the end of their work shift.

405.4 Decontamination of Equipment

Heavy equipment, hand tools, and sampling devices contaminated in the exclusion zone must be de-contaminated before re-use or removal from the site. Equipment and tools must be cleaned periodically to reduce continual contact with contamination. All equipment must be decontaminated before it is taken off-site to leave contamination on the site. Sampling equipment must also be decontaminated between samples to prevent cross-contamination of the samples.

All major reusable equipment and other tools used for site investigation activities should be decontaminated prior to leaving the site area. Cleaning should consist of scrubbing to remove encrusted materials followed by a detergent-and water wash and potable water rinse using a high-pressure low volume water spray or steam-cleaning unit. High pressure and/or heat should be used only as necessary and with caution because they can spread contamination and cause burns. Additional rinses with other solvents, such as methanol and hexane, may be used if warranted by the nature of the chemicals encountered. These solvents may present additional inherent hazards of chemical exposure and special precautions must be taken when handling these chemicals. An MSDS or other equivalent information must accompany the chemicals on-site.

Sampling equipment must be decontaminated to ensure the integrity of the samples and to prevent cross-contamination. It is common to use solvents and acids (e.g. acetone and nitric acid) to decontaminate equipment between samples. These chemicals must also be handled with care.

Decontamination should be performed at a designated equipment decontamination area on the site. An excavated sump may be used to collect wash water as needed. Following decontamination, the clean equipment should be stored on plastic sheeting.

The under carriage of all vehicles (e.g. trucks, etc.) should be cleaned prior to driving them off the site. At the conclusion of site work, all major equipment should be thoroughly cleaned using the method described above.

405.5 Level of Protection For Decontamination Personnel

In some cases, decontamination personnel should wear the same levels of PPE as workers in the Exclusion Zone. In other cases, decontamination personnel may be sufficiently protected by wearing protection of one level lower (e.g., wearing level C protection while decontaminating workers who are wearing level B protection). Because all decontamination workers are in a contaminated area they must be decontaminated before entering the clean support zone.

405.6 Decontamination Solution

A decontamination solution should be capable of removing, or converting to a harmless substance, the contaminant of concern without harming the object being decontaminated. The preferred solution is a mixture of detergent and water, which is a relatively safe option compared to chemical decontaminants. A solution recommended for decontaminating boot covers and gloves consists of 1 to 1.5 tablespoons of Alconox per gallon of warm water. Skin surfaces should be decontaminated by washing with hand soap and water. The decontamination solution must be changed when it no longer foams or when it becomes extremely dirty. Rinse water must be changed when it becomes discolored, begins to foam, or when the decontamination solution cannot be removed.

Organic or halogenated solvents may be needed to remove contaminants when detergents are not effective. These chemicals, themselves, present potential hazards of toxicity, flammability, and incompatibility with most types of PPE. Special handling and disposal procedures may be needed along with MSDS for the solvents.

405.7 Disposal of Decontamination Solutions

All decontamination solutions should be contained, collected, and packaged for disposal. Arrangements should be made with the client for disposal of the solutions. If the effluent is treatable it may be permissible to discharge it into a chemical or sanitary sewage system. Otherwise, it may need to be transported to a treatment facility. It is very important to generate minimum quantities of decontamination solutions.

405.8 Emergency Decontamination

Hazardous waste facilities should also have in place emergency decontamination procedures, in order to prevent the loss of life or severe injury to site personnel. In the case of threat to life, decontamination should be delayed until the victim is stabilized; however, decontamination should always be performed first, when practical, if it can be done without interfering with essential lifesaving techniques or first aid, or if a worker has been contaminated with an extremely toxic or corrosive material that could cause severe injury or loss of life. During an emergency, provisions must also be made for protecting medical personnel and disposing of contaminated clothing or equipment.

405.9 References

- EPA Standard Operating Safety Guidelines; Publication 9285.1-03, June 1992.
- The Code of Federal Regulations, Title 29, 1910.120; July 1, 1993.
- Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities; October 1985.

ATTACHMENT 1

SAMPLE PERSONNEL DECONTAMINATION FACILITY SET-UP

The decon facility should have a minimum of four stations: (1) segregated equipment drop station, (2) coverall, boot, and glove wash and rinse station, (3) coverall and outer glove removal station, and (4) respirator, boot, and inner glove removal station.

Station 1—Segregated Equipment Drop

Deposit equipment used in the exclusion zone (e.g. tools, sampling devices and containers, monitoring equipment, radios, clipboards, etc.) on a plastic drop cloth or in plastic lined containers.

Station 2—Boot Cover Wash And Rinse

Step into the first container of decontamination solution and scrub bottom and sides of boot covers up to taped area to remove gross contamination. After boot covers have been scrubbed, step into the second container of decontamination solution and repeat the washing process. Finally, step into container of rinse water and rinse boot covers thoroughly. Proceed to Station 3.

Station 3—Outer Glove Wash And Rinse

Place gloved hands in container of decontamination solution and wash gloves. Use a brush if necessary. After washing the gloves, place hands in container of rinse water and rinse gloves thoroughly. This station and Station 2 may be combined into one station if protective equipment is not grossly contaminated.

Station 4—Coverall And Outer Glove Removal

If used, remove tape from legs and wrists as well as from coverall zipper. Then, remove outer gloves and coverall, in that order. Care must be taken to prevent transfer of contaminants from coverall to underclothes. Transfer can be minimized by rolling or folding the coverall as it is being removed so that the coverall is turned inside-out. Place tape, coveralls, and outer gloves in the plastic-lined receptacle provided at this station.

Remove respirator and boots and place them in receptacles provided at this station. Remove inner gloves and discard in receptacle provided.

Station 6—Hand And Face Wash And Street Shoe Donning

Wash, rinse and dry hands and face, then don street shoes. If highly toxic, corrosive, or skin absorbable chemicals are known to be present, a shower facility should be set-up in the support area and personnel required to shower before leaving the site.

ATTACHMENT 2

SAMPLE DECONTAMINATION EQUIPMENT AND SUPPLIES

- One or two plastic drop cloths, minimum thickness of 3 mills and minimum size to 9x12 feet.
- Four to seven containers, 30- to 50-gallon capacity (galvanized tub, stock tank, or children's wading pool), for washing and rinsing.
- One or two receptacles (drums or plastic trashcans) for receiving contaminated disposable equipment and trash.
- One or two 55-gallon drums for storage of contaminated wash and rinse water.
- Plastic trash bags of different sizes for temporary storage of contaminated equipment and for lining trash receptacles.
- Two to four long-handled soft bristled brushes (e.g. toilet brush).
- Three to four-inch diameter plastic pipe or 4x4-inch timber (or other methods) to raise edges of drop cloth to contain contaminated wash and rinse water spilled during decontamination.
- Detergent (e.g. Alconox)
- Hand soap
- Fresh water
- Paper towels for drying hands, face, and equipment.
- Chairs or benches for personnel to sit on while removing boots.
- Shower facility with lockers (optional).